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Radian Corp., Research Triangle Park, NC

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1989 NONMETHANE ORGANIC COMPOUND MONITORING PROGRAM

AND

THREE-HOUR AIR TOXICS MONITORING PROGRAM

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In certain areas of the country where the National Ambient Air Quality Standard (NAAQS) for ozone is being exceeded, additional measurements of ambient nonmethane organic compounds (NMOC) are needed to assist the affected States in developing revised ozone control strategies. Because of previous difficulty in obtaining accurate NMOC measurements, the U.S. Environmental Protection Agency (EPA) has provided monitoring and analytical assistance to these States, beginning in 1984 and continuing through the 1989 NMOC Monitoring Program.

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1989 NONMETHANE ORGANIC COMPOUND MONITORING PROGRAM
AND
THREE-HOUR AIR TOXICS MONITORING PROGRAM

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SYMBOLS AND ABBREVIATIONS

AC, or A.C.	area counts, generated from a gas chromatograph
ADELTA	absolute value of DELTA
ADIF	absolute value of DIF
ADIFF	absolute value of DIFF
AIRS	Aerometric Information Retrieval System
ALCA	Alpine, CA - AIRS No. 29-510-0072
a.m.	ante meridiem
APDIFF	absolute value of PDIFF
APDIF	absolute value of PDIF
APR	April
AREAL	Atmospheric Research and Exposure Assessment Laboratory
Aug	August

BACA	Bakersfield, CA - AIRS No. 06-029-0004
Bldg.	building
BMTX	Beaumont, TX - AIRS No. 48-245-0009

C3IL	Chicago, Illinois - AIRS No. 17-031-0042
C6IL	Chicago, Illinois - AIRS No. 17-031-0063
Cal., or Calib.	calibration
cm	centimeter

DELTA	Radian NMOC concentration - QAD NMOC concentration, ppmC; Radian NMOC concentration - ASRL concentration, ppmC; or AREAL NMOC concentration - QAD NMOC concentration, ppmC
DIF	(NMOC concentration for the second channel) - (NMOC concentration for the first channel
DIFF	measured NMOC concentration - calculated NMOC concentration ppmC for in-house quality control samples
DLTX	Dallas, TX - AIRS No. 48-113-0069
Dup.	duplicate

e	base of natural logarithm, 2.71828...
ECD	electron capture detector
ELCA	El Cajon, CA - AIRS No. 06-073-0003
ELTX	El Paso, TX - AIRS No. 48-141-0037
EPA	United States Environmental Protection Agency

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SYMBOLS AND ABBREVIATIONS (continued)

F	Friday
FID	flame ionization detector
FECA	Fremont, CA - AIRS No. 06-001-1001
GC/ECD	gas chromatography electron capture detection
GC/FID	gas chromatography flame ionization detection
GC/MD	gas chromatography multidetection
GC/MS	gas chromatography mass spectrometry
GRMI	Grand Rapids, MI - AIRS No. 26-081-0020
H	Thursday
H1TX	Houston, TX - AIRS No. 48-201-1034
Hg	mercury
i.d.	inside diameter
ID	identification
INST.	instrument
Jul	July
Jun	June
L	liter
LBCA	Long Beach, CA - AIRS No. 06-037-4002
Lpm	liters per minute
LXKY	Lexington, KY - AIRS No. 21-067-0012
m	meter
M	Monday
M1NY	New York, NY - AIRS No. 36-061-0056
MAX	maximum
MGAL	Montgomery, AL - AIRS No. 01-101-0008
MID	multiple ion detection
MIN	minimum
min.	minute
mL	milliliter
mm	millimeter
MNY	New York, NY - AIRS No. 36-061-0010
MU	mean of ln(NMOC)

(Continued)

SYMBOLS AND ABBREVIATIONS (continued)

NC	North Carolina
NIST	National Institute of Standards and Technology
NMOC	Nonmethane organic compound
NOx	oxides of nitrogen
NWNJ	Newark, NJ - AIRS No. 34-013-011
Oct	October
o.d.	outside diameter
Off.	Office
PCDIFF	percent difference = DIFF/calculated NMOC concentration x 100, for in-house QC samples
PDELTA	$\frac{\text{DELTA}}{[(\text{Radian NMOC concentration} + \text{QAD NMOC concentration})/2]} \times 100$; $\frac{\text{DELTA}}{[(\text{Radian NMOC concentration} + \text{AREAL NMOC concentration})/2]} \times 100$; or, $\frac{\text{DELTA}}{[(\text{AREAL NMOC concentration} + \text{QAD NMOC concentration})/2]} \times 100$
PDFID	preconcentration, direct flame ionization detection
PDIF	DIF/([(NMOC concentration, 1st channel) + (NMOC concentration, 2nd channel)]/2) x 100
PLNJ	Plainfield, NJ - AIRS No. 34-035-1001
p.m.	post meridiem
ppb	parts per billion
ppbv	parts per billion by volume
ppm	parts per million
ppmC	parts per million by volume as carbon
ppmv	parts per million by volume
psi	pounds (force) per square inch
psig	pounds (force) per square inch gauge
QA	quality assurance
QAD	Quality Assurance Division (EPA)
QAPP	Quality Assurance Project Plan
QC	quality control
RAO	Radian analysis order: RAO = 1 for the local ambient duplicate sample analyzed first by Radian; RAO = 2 for the local ambient duplicate sample analyzed first by EPA
RT	retention time
RTP	Research Triangle Park

(Continued)

SYMBOLS AND ABBREVIATIONS (continued)

S2MO	St. Louis, MO - AIRS No. 29-510-0072
SAROAD	Storage and Retrieval of Aerometric Data
Sep	September
SOP	standard operating procedure
SOx	oxides of sulfur
SRM	Standard Reference Material
SIGMA	standard deviation of ln(NMOC)
STD. DEV., SD	standard deviation
T	Tuesday
UATMP	Urban Air Toxics Monitoring Program
U.S.	United States
UTM	Universal Transverse Mercator
W	Wednesday
°C	degrees Celsius
°F	degrees Fahrenheit
%CV	percent coefficient of variation

1.0 SUMMARY AND CONCLUSIONS

In certain areas of the country where the National Ambient Air Quality Standard (NAAQS) for ozone is being exceeded, additional measurements of ambient nonmethane organic compounds (NMOC) are needed to assist the affected states in developing revised ozone control strategies. Because of previous difficulty in obtaining accurate NMOC measurements, the U.S. Environmental Protection Agency (EPA) has provided monitoring and analytical assistance to these states through Radian Corporation. This assistance began in 1984 and continues through the 1989 NMOC Monitoring Program.

Between June 5 and September 29, 1989, Radian analyzed 1,956 ambient air samples, including 194 duplicate samples, collected in SUMMA® polished stainless steel canisters at 23 sites. These NMOC analyses were performed by the cryogenic preconcentration, direct flame ionization detection (PDFID) method.[1] Based on the 1984 through 1988 studies, the method was shown to be precise, accurate, and cost effective relative to the capillary column gas chromatographic, flame ionization detection (GC/FID) method (see Appendix B). The 1989 study confirmed these findings and supported the conclusion that the PDFID method is the method of choice to measure NMOC concentration in ambient air.

In 1986 specific toxic compounds, primarily aromatics and halocarbons, were also determined in the ambient air samples used for the NMOC analyses. In 1987 Radian Corporation developed a gas chromatographic multidetector (GC/MD) method to determine the concentration of 38 selected toxic organic compounds in ambient air. In 1988, air toxic analyses were conducted by GC/MD on ambient air samples taken at 13 sites at which NMOC samples were taken. In 1989, air toxic analyses were conducted on ambient air samples taken at seven sites at which NMOC samples were taken. These samples were called 3-hour air toxics samples because the sampling period was three hours, from 6:00 a.m. to 9:00 a.m. The 1989 Urban Air Toxics Monitoring Program (UATMP) began in January 1989 at 13 urban sites and extended through December 1989. The samples from the latter program were 24-hour integrated ambient air samples and are referred to as UATMP samples throughout this report.

The Final Report for the 1989 Nonmethane Organic Compound and Three-Hour Air Toxics Monitoring program are included in Sections 1.0 through

10.0. Sections 1.0 through 6.0 report the data, procedures, and assessment of the NMOC portion of the monitoring program. Sections 7.0 through 9.0 report the data, procedures, and assessment of the 3-hour air toxics portion of the monitoring program. Section 10.0 lists references.

The sampling sites for the 1989 NMOC Monitoring Program are listed in Appendix A. Appendix A also gives the EPA Regions for each site, the Radian Site Code, the Storage and Retrieval of Aerometric Data (SAROAD) numbers, the Aerometric Information Retrieval System (AIRS) numbers, and whether or not 3-hour air toxics analyses were performed on selected ambient air samples from the site.

Appendix B contains the detailed instructions on the Cryogenic Preconcentration and Direct Flame Ionization Detection (PDFID) method. Appendix C lists the 1989 NMOC Monitoring Program Site Data. Appendix D lists the 1989 NMOC Monitoring Program Invalidated and Missing Samples information. Appendix E gives PDFID Integrator Programming Instructions. Appendix F gives 1989 NMOC Daily Calibration Data. Appendix G gives 1989 In-House Quality Control Samples, and Appendix H gives Multiple Detector Speciated Three-Hour Site Data Summaries.

The UATMP data and results will be reported under separate cover in a final report for the UATMP.

1.1 NMOC MONITORING PROGRAM

1.1.1 Introduction and Data Summary

Table 1-1 gives details of the sample completeness results. Percent completeness, a quality measure is shown in Table 1-1. Completeness, which ratios the number of valid samples to the number of scheduled samples, averaged 95.5% in 1989 compared to 93.4% in 1988, 95.0% in 1987, 96.8% in 1986, 95.8% in 1985, and 90.6% in 1984. Percent completeness for 1989 ranged from 86.81 at S3CA (AIRS No. 66-067-0010, Sacramento, CA) to 101.10 for ELTX (AIRS No. 48-141-0037, El Paso, TX). During the last week of the 1989 NMOC Monitoring Program, the ELTX site had one more cleaned canister than was needed to complete its scheduled samples, so an extra duplicate was collected.

TABLE 1-1. 1989 COMPLETENESS RESULTS

Radian Site Code Complete	Scheduled Sampling Days	Total Scheduled Duplicate Samples	Total Scheduled Samples	Total Valid Duplicate Samples	Total Valid Samples	Percent
ALCA	83	8	91	11	89	97.80
BACA	83	8	91	10	83	91.21
BMTX	83	8	91	10	90	98.90
C3IL	83	8	91	8	84	92.31
C6IL	83	8	91	7	85	93.41
DLTX	83	8	91	8	91	100.00
ELCA	83	8	91	7	85	93.41
ELTX	83	8	91	8	92	101.10
FECA	83	8	91	8	87	95.60
GRMI	83	8	91	7	88	96.70
H1TX	82	8	90	9	83	92.22
LBCA	67	8	75	7	71	94.67
LXKY	83	8	91	9	91	100.00
M1NY	82	8	90	9	89	98.89
MGAL	83	8	91	8	86	94.51
NMY	83	8	91	8	85	93.41
NWNJ	83	8	91	8	88	96.70
PLNJ	83	8	91	10	87	95.60
RLNC	83	8	91	7	90	98.90
RSCA	59	7	66	9	59	89.39
S2MO	82	8	90	8	88	97.78
S3CA	83	8	91	10	79	86.81
S4CA	83	8	91	8	86	94.51
Overall	1866	183	2049	194	1956	95.46

Statistics for the NMOC concentrations in parts per million carbon (ppmC) by volume are listed in Table 1-2. In Table 1-2, the sites are divided into "Morning Sites," "Late Morning Sites," and "Above-300-m-Altitude Sites." The Morning Sites are those that collected samples from 6:00 a.m. to 9:00 a.m.; Late Morning Sites sampled from 9:00 a.m. to noon; the Above-300-m-Altitude Sites sampled from 6:00 a.m. to 9:00 a.m. at an altitude above 300 meters.

The sites were separated into these classifications because experience has shown[3] the average NMOC concentrations to be different for the three groups. The overall mean NMOC concentration for the Morning Sites was 0.577 ppmC, while for the Late Morning Sites, the mean was 0.158 ppmC. The mean for the Above-300-m-Altitude Site was 0.267 ppmC.

1.1.2 Calibration and Drift

Each Radian PDFID channel was calibrated twice daily, using propane standards referenced to the National Institute of Science and Technology (NIST) Reference Material No. 1666B propane. Daily, before zero and calibration checks were performed, the analytical systems were purged with cleaned, dried air that had been humidified. Zero readings were determined with cleaned, dried air. Daily percent drift of the calibration factor ranged from -4.5% to +4.5%, averaging -0.375 percent. The absolute value of the percent drift of the daily calibration factors ranged from zero to 4.5%, averaging 0.61 percent.

1.1.3 Precision

Analytical precision was determined by repeated analyses of 156 site samples. Percent differences between the second and the first analysis averaged -0.019 percent. The average of the absolute values of the percent difference was 8.2% with a standard deviation of 12.1. The analytical precision includes the variability between Radian channels and within Radian channels. The data quality objective for this measurement as published in the 1989 Quality Assurance Project Plan (QAPP)[2] was 9.8%, based on previous NMOC program experience[3] with this measurement.

Overall precision, including sampling and analysis variability, was determined by analysis of 181 duplicate site samples, simultaneously collected in two canisters from a common sampling system. Percent difference for Radian's analyses of the duplicates averaged 4.2 percent. The average

TABLE 1-2. 1989 NMOC SITE STATISTICS

Radian Site Code	NMOC, ppmC						
	Minimum	Median	Mean	Maximum	Standard Deviation	Skewness	Kurtosis
Morning Sites (Sampling 6:00 to 9:00 a.m., local time)							
BACA	0.150	0.799	0.809	2.499	0.409	0.917	2.185
BMTX	0.220	0.655	0.830	4.047	0.631	2.880	10.367
C6IL	0.126	0.764	0.851	2.663	0.506	1.233	2.013
DLTX	0.114	0.421	0.474	1.612	0.285	1.548	3.111
ELCA	0.088	0.305	0.452	1.733	0.366	1.644	2.260
ELTX	0.093	0.381	0.498	2.442	0.402	2.375	6.917
FECA	0.124	0.371	0.519	2.491	0.411	2.068	5.795
GRMI	0.203	0.517	0.641	1.880	0.387	1.234	0.739
H1TX	0.180	0.632	0.791	2.614	0.479	1.251	1.639
LBCA	0.242	0.697	0.881	2.855	0.573	1.606	1.922
LXKY	0.082	0.270	0.377	1.796	0.342	2.547	6.574
M1NY	0.211	0.527	0.601	2.043	0.336	1.935	5.180
MGAL	0.087	0.192	0.221	1.133	0.156	4.299	21.667
MNY	0.127	0.515	0.555	1.609	0.286	1.222	1.819
NWNJ	0.158	0.519	0.652	3.693	0.539	2.944	11.375
PLNJ	0.073	0.407	0.529	1.796	0.384	1.354	1.316
RLNC	0.137	0.137	0.162	0.551	0.162	1.368	1.916
RSCA	0.210	1.113	1.224	3.993	0.796	1.278	1.666
S2MO	0.187	0.607	0.747	5.013	0.640	3.941	21.229
S3CA	0.075	0.205	0.310	2.452	0.340	3.920	19.325
S4CA	0.061	0.179	0.262	1.534	0.266	3.192	11.112
Overall	0.043	0.434	0.577	5.013	0.493	2.461	10.334
Late Morning Site (Sampling 9:00 a.m. to noon, local time)							
ALCA	0.037	0.117	0.158	0.867	0.151	3.560	12.838
Above-300-m-Altitude Site (Sampling 6:00 to 9:00 a.m., local time)							
C3IL	0.042	0.228	0.267	0.954	0.172	1.481	2.721

absolute percent difference was 10.6% with a standard deviation of 14.2. The data quality objective for this measurement was 12.2%, based on previous experience.[2]

1.1.4 Accuracy

Because the NMOC measurements encompass a range of mixtures of unknown compounds, it was not possible to define absolute accuracy. Instead, accuracy was determined relative to propane standards with internal and external audit samples.

Accuracy was monitored internally throughout the program by the use of in-house propane standards. Four days per week an in-house propane quality control (QC) sample was prepared with a flow dilution apparatus and analyzed by the PDFID method. The propane used to prepare the in-house QC standards was certified by the EPA Quality Assurance Division (QAD) and was referenced to NIST No. 1666B.

Figures 1-1 through 1-4 show the in-house quality control results for Radian Channels A, B, C, and D. Measured propane values are plotted against calculated propane standards. Table 1-3 shows the linear regression parameters for the Radian in-house quality control data. Daily quality control samples of propane were mixed from a propane standard certified by EPA-QAD and referenced to NIST propane Standard No. 1666B. The regression used the propane concentration calculated from the mixing operation as the independent variable and concentration measured by each Radian channel as the dependent variable. The concentration range of the in-house quality control samples was 0.020 to 18.000 ppmC. Table 1-3 indicates excellent quality control for each channel since, as expected, the intercepts are all near zero, and the slopes and coefficients of correlation are all near 1.0.

External propane audit samples were provided by EPA-QAD. The propane samples were referenced to NIST propane Standard No. 1666B. Table 1-4 summarizes the percent bias of the Radian channels and the EPA Atmospheric Research and Exposure Assessment Laboratory (AREAL) channel relative to the EPA-QAD channel. The audit samples were given Radian ID Numbers upon receipt. Radian ID No. 1004 was received in May 1989, and the other two audit samples were received in September 1989. The average percent bias for the Radian

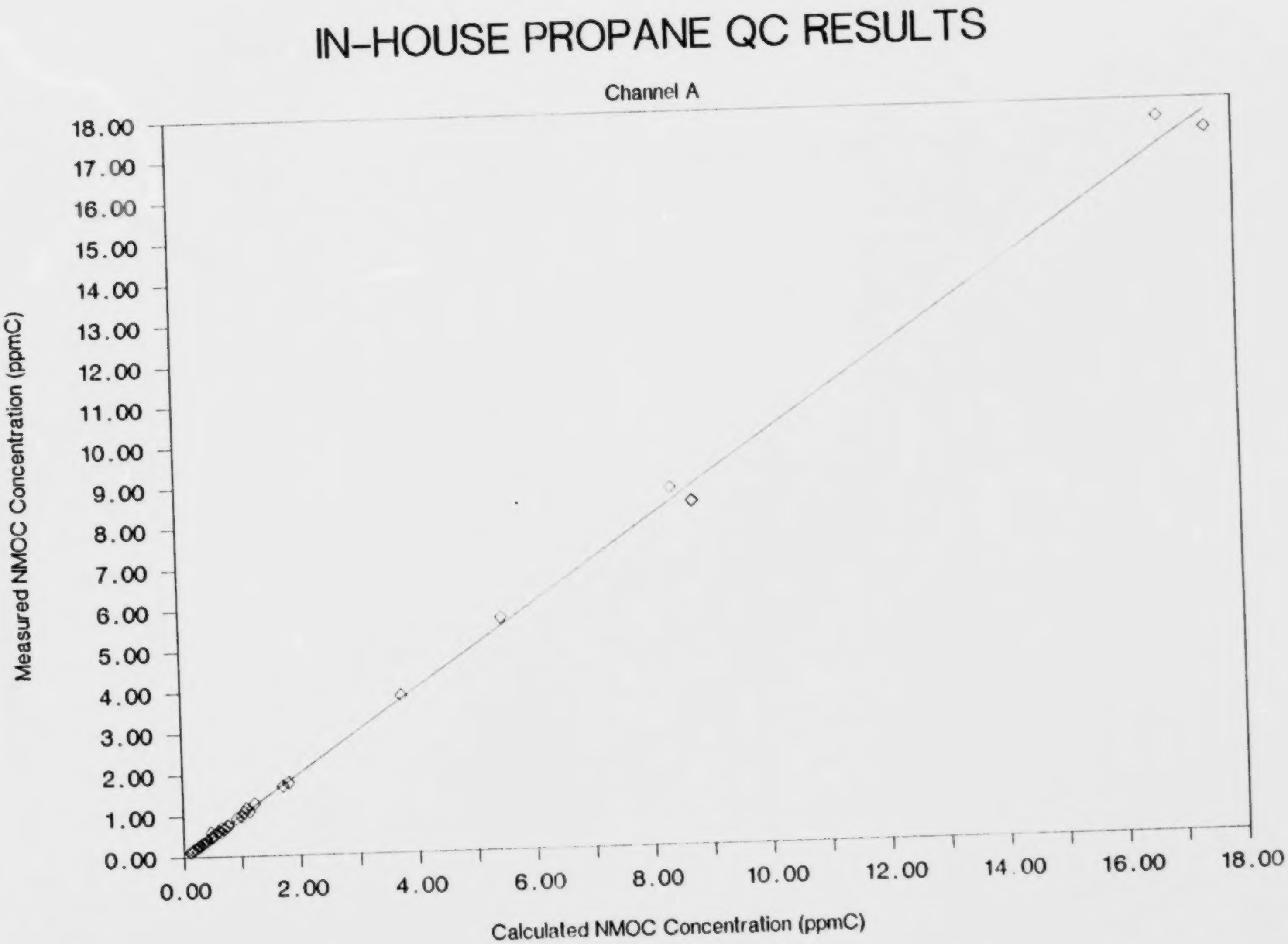

Figure 1-1. In-house quality control results, Channel A.

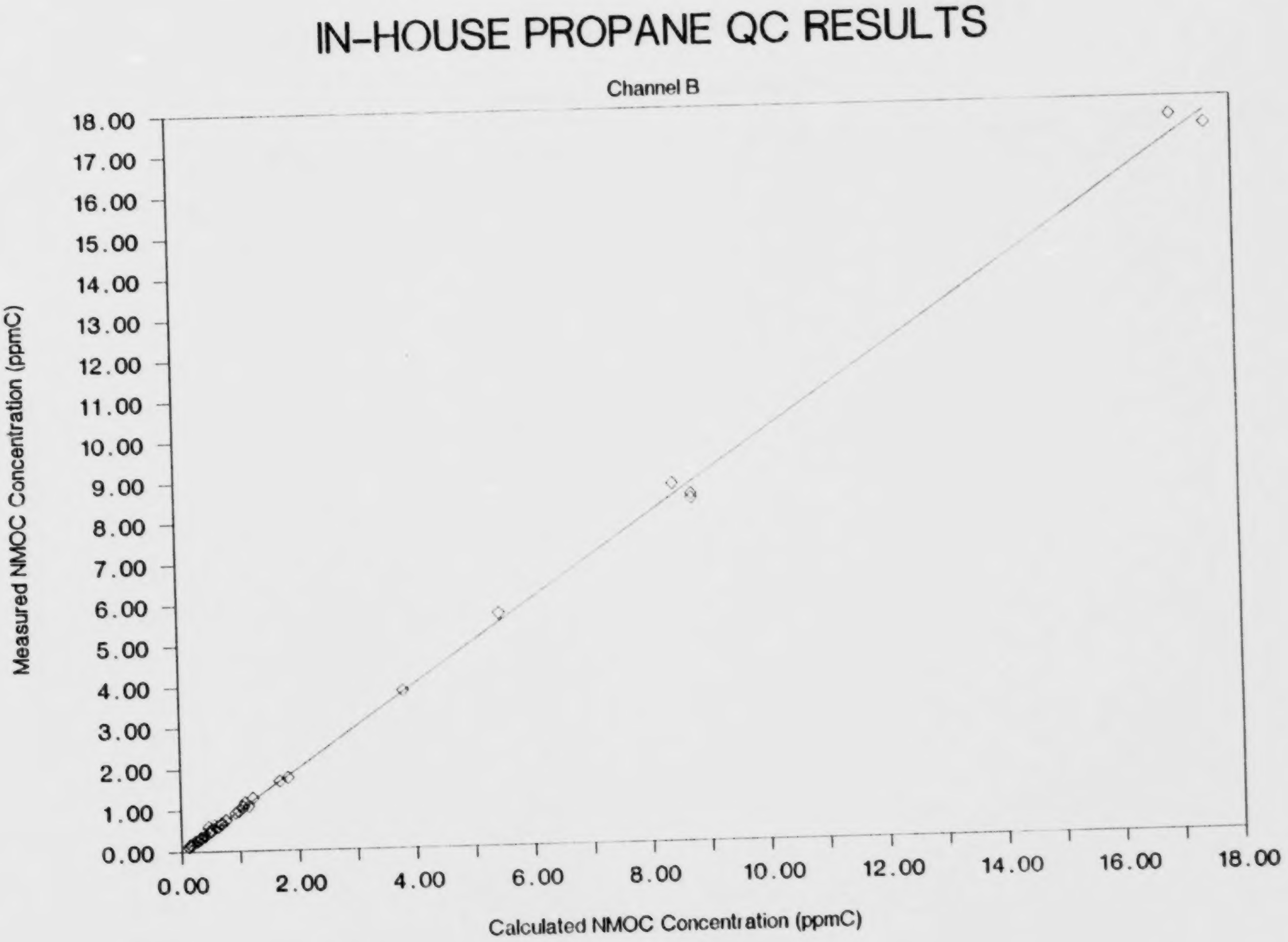

Figure 1-2. In-house quality control results, Channel B.

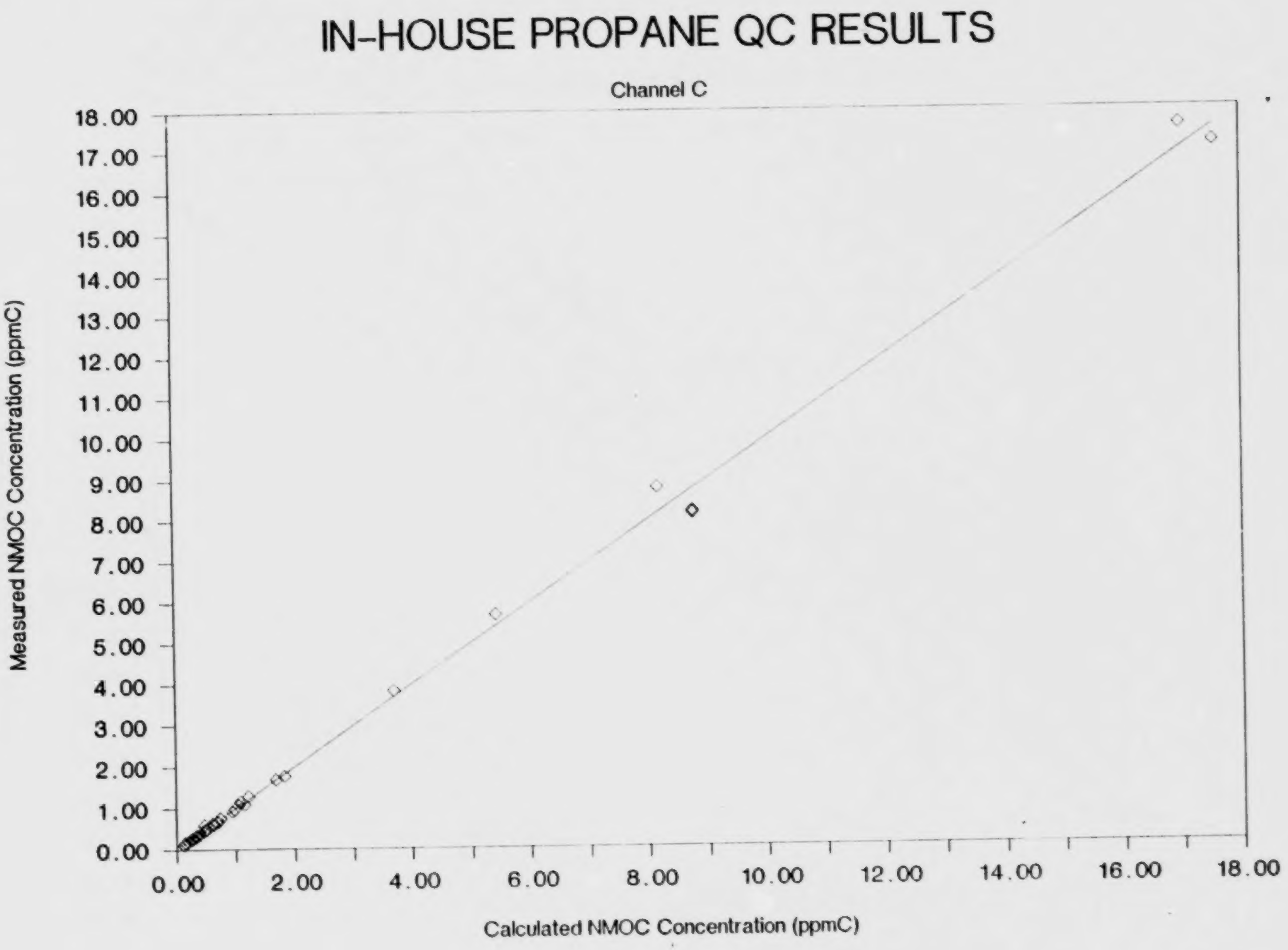

Figure 1-3. In-house quality control results, Channel C.

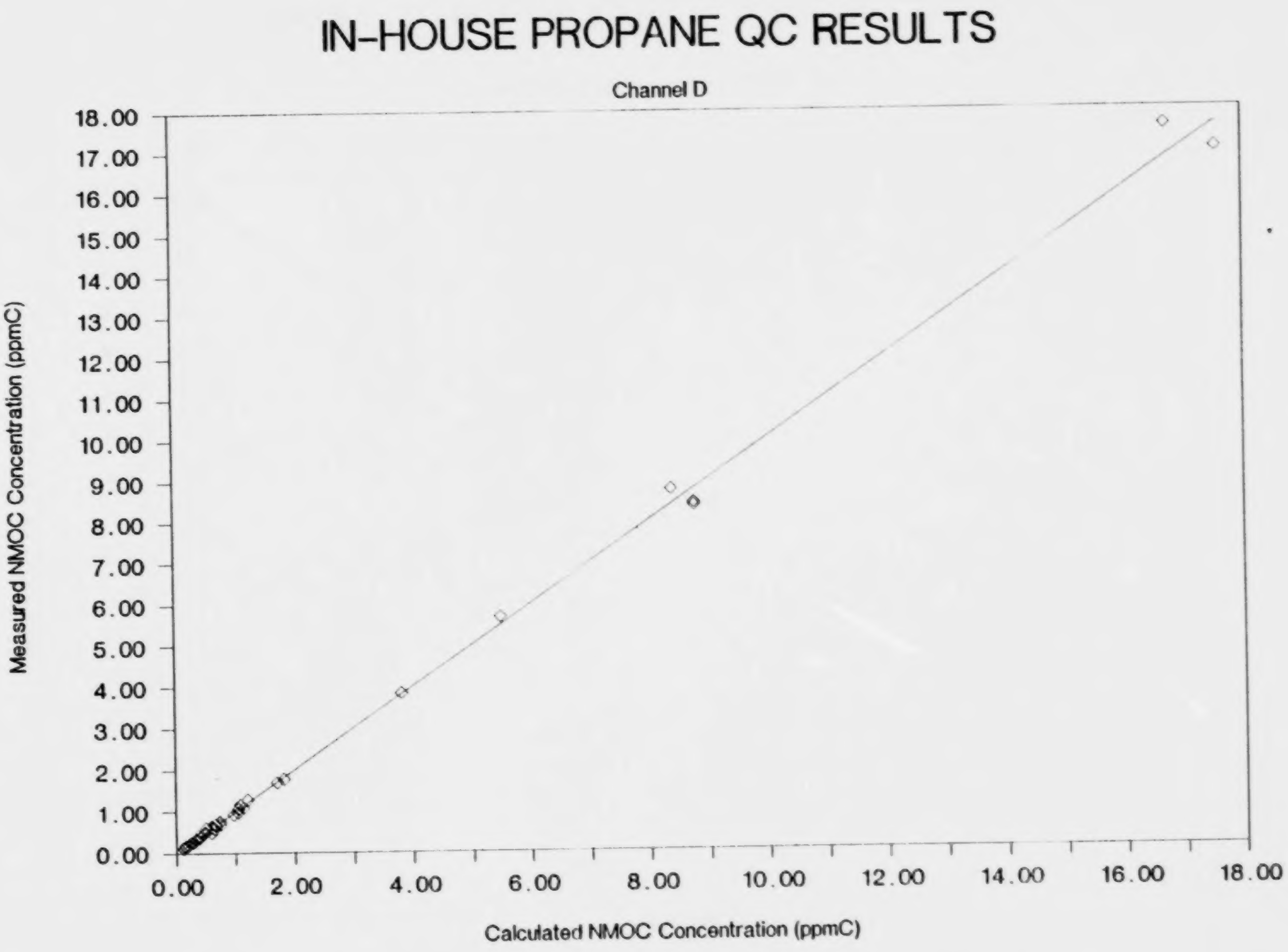

Figure 1-4. In-house quality control results, Channel D.

TABLE 1-3. LINEAR REGRESSION PARAMETERS FOR IN-HOUSE QUALITY CONTROL DATA

Radian Channel	Cases	Intercept	Slope	Coefficient of Correlation
A	51	-0.000182	1.007578	0.999184
B	51	0.005195	1.004650	0.999457
C	51	0.010023	0.997043	0.998786
D	51	0.001783	1.002389	0.998910

TABLE 1-4. AUDIT SAMPLE RESULTS, PERCENT BIAS[a]

Radian ID Number	Channels A Percent Bias	 B Percent Bias	 C Percent Bias	 D Percent Bias	Radian Percent Bias
1005	0.00	-1.13	-1.04	-1.04	
1006	-0.96	-3.23	1.05	0.99	
1647	3.30	5.50	3.85	2.75	
1648	0.86	1.26	0.93	1.26	
1969	2.21	4.70	0.41	-0.69	
2290	-2.40	-3.41	1.01	-5.18	
3020	1.72	-0.69	-0.86	-3.78	
3021	-3.26	-1.68	-10.15	-3.16	
Average	0.78	0.16	0.80	-1.11	-0.34
Std. Dev.	2.24	3.39	4.14	2.75	3.22

[a] Percent Bias = [(Measured NMOC - QAD NMOC) / QAD NMOC] x 100.

channels was 0.84%, ranging from 0.30% for Channel B to 1.29% for Channel C. Absolute percent biases are listed in Table 1-5 and range from 1.84% for Channel A to 2.70% for Channel B, averaging 2.33% overall for the Radian channels.

1.1.5 Other Quality Assurance Measurements

The results of other quality assurance measurements are discussed below. Canister cleanup studies established that there was little carryover of NMOC from one sample to the next, using the canister cleanup apparatus and procedure developed for this study. In 206 separate determinations, percent cleanup averaged 99.742%, ranging from 92.12% to 100 percent. Cleanup was defined in terms of the percent of the NMOC concentration that was removed in the cleanup cycle. Figure 1-5 shows a between-laboratory comparison of site sample analyses involving Radian channels and the EPA-QAD channel for the PDFID method. Figure 1-6 shows comparisons of EPA-ASRL and EPA-QAD channels. Table 1-6 gives the orthogonal regression parameters, assuming a linear relationship, for Figures 1-5 and 1-6 and other possible comparisons. The results show good agreement because the intercepts are very close to zero, the slopes are within 10% of 1.0, and the coefficients of correlation are within 3% of 1.0. Approximately 14.6% of the NMOC data base was validated by checking data transcriptions from original data sheets for 36 entries per sample. The errors found equal a data base error rate of 0.369 percent. The data validation included 100% of the reported NMOC concentration values. All errors that were found were corrected.

1.2 THREE-HOUR AIR TOXICS MONITORING PROGRAM

At seven sites, 3-hour NMOC samples were speciated by a GC/MD analytical system for 38 UATMP target compounds for a total of 64 NMOC ambient air samples. After NMOC analysis, the NMOC sample canisters were bled to atmospheric pressure, stored at least 18 hours for equilibration, and then analyzed by GC/MD. Duplicate samples were collected at all seven of the sites simultaneously and analyzed individually by GC/MD. Replicate analyses were performed on one duplicate sample per site. A total of 78 GC/MD analyses were performed, including duplicate samples and replicate analyses.

TABLE 1-5. AUDIT SAMPLE RESULTS, ABSOLUTE PERCENT BIAS

Radian ID Number	Channels A Percent Bias	Channels B Percent Bias	Channels C Percent Bias	Channels D Percent Bias	Radian Absolute Percent Bias
1005	0.00	1.13	1.04	1.04	
1006	0.96	3.24	1.06	0.99	
1647	3.30	5.50	3.85	2.75	
1648	0.86	1.26	0.93	1.26	
1969	2.21	4.70	0.41	0.69	
2290	2.40	3.41	1.01	5.18	
3020	1.72	0.69	0.86	3.78	
3021	3.26	1.68	10.15	3.16	
Average	1.84	2.70	2.41	2.35776	2.32761
Std. Dev.	1.18	1.79	3.30	1.62150	2.12701

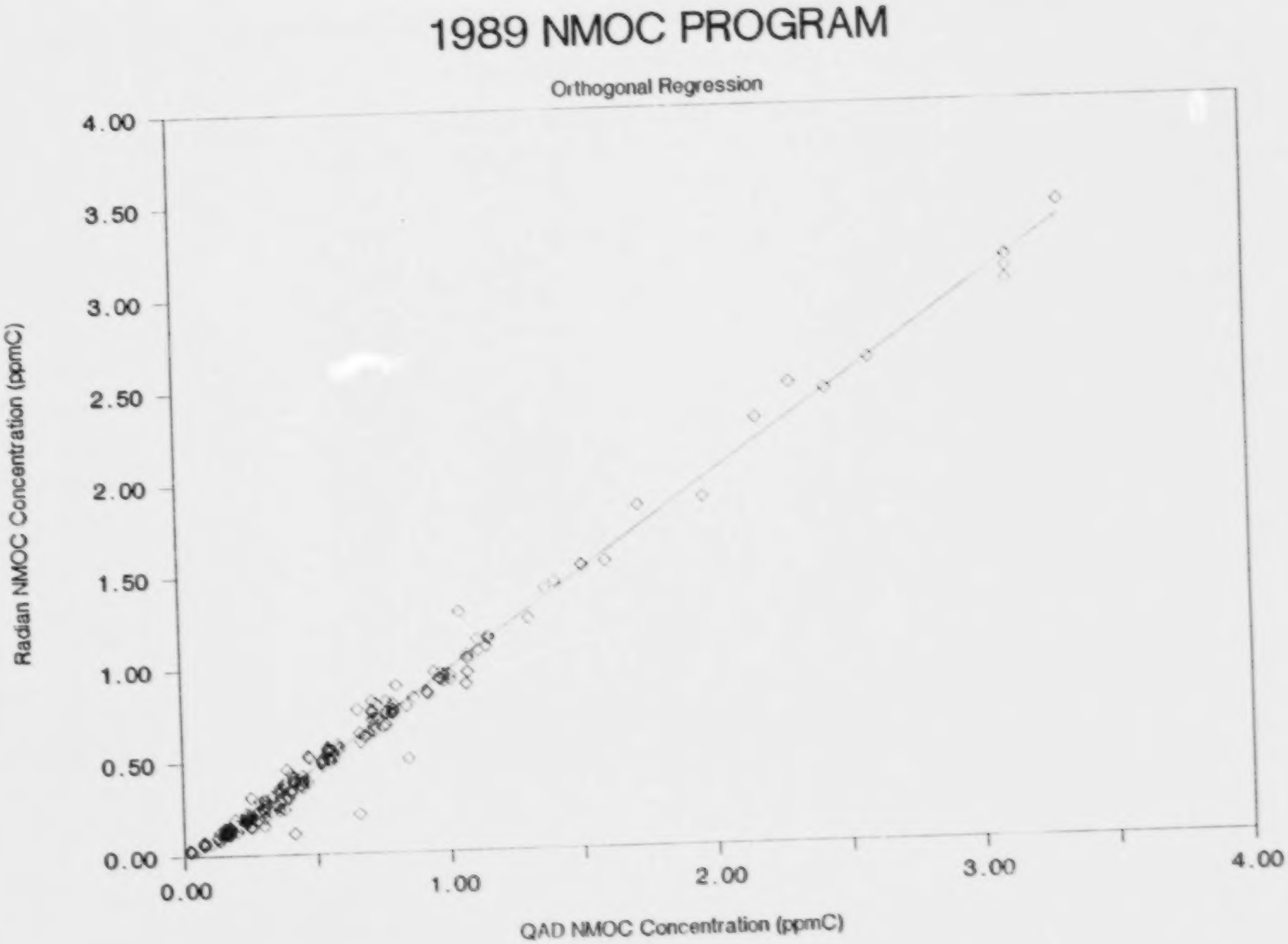

Figure 1-5. Orthogonal regression comparing QAD with Radian NMOC analyses.

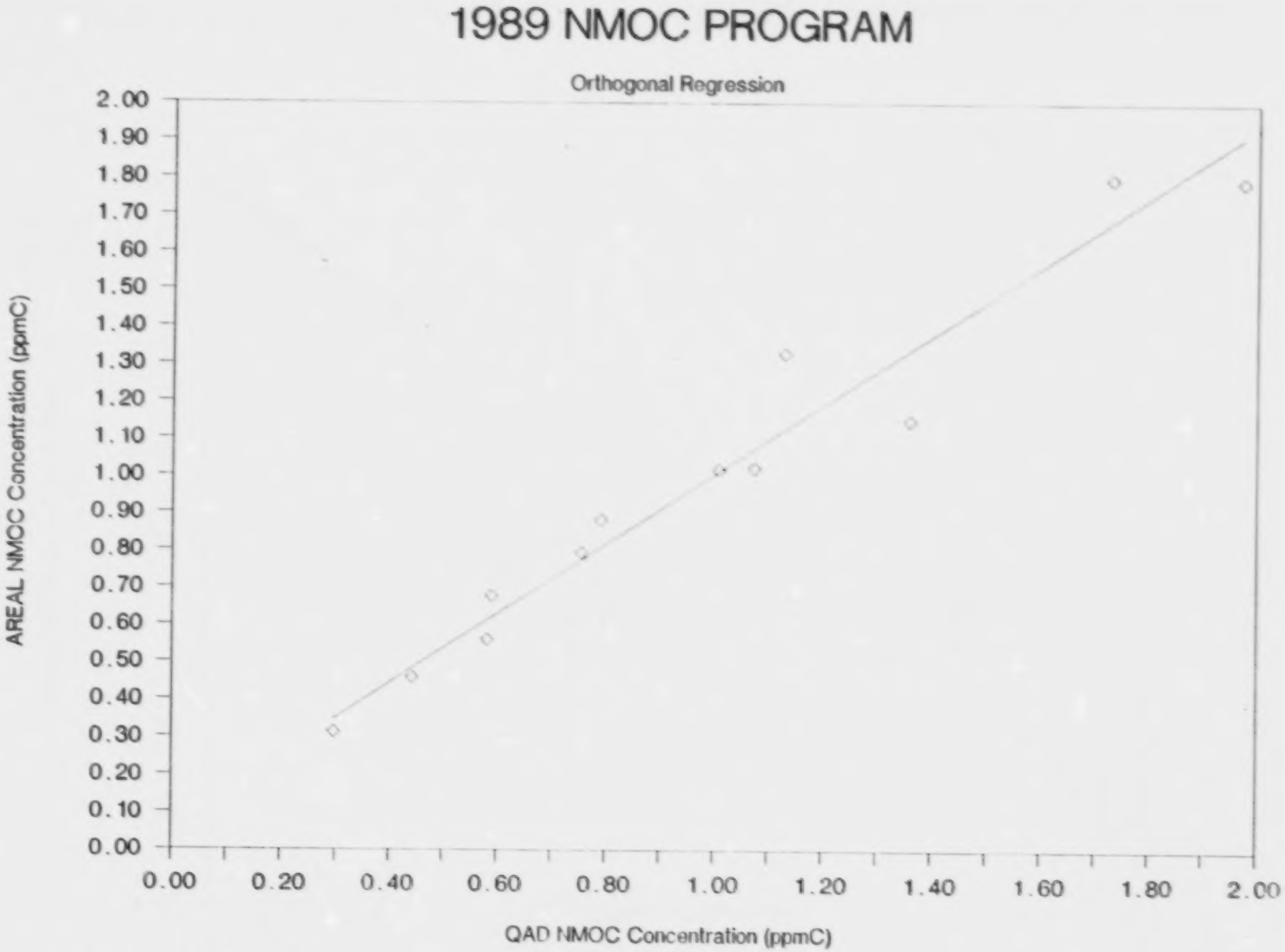

Figure 1-6. Orthogonal regression comparing QAD with AREAL NMOC analyses.

TABLE 1-6. ORTHOGONAL REGRESSION PARAMETERS FOR COMPARATIVE ANALYSES OF SITE SAMPLES

Channel Pair (X-Y)	Cases	Intercept	Slope	Coefficient of Correlation
QAD-Radian	202	-0.038190	1.025019	0.995887
Radian-QAD	202	0.037260	0.975590	0.995887
AREAL-Radian	20	-0.136310	1.098092	0.995908
Radian-AREAL	20	0.124140	0.910670	0.995908
QAD-AREAL	12	0.069707	0.933637	0.975807
AREAL-QAD	12	-0.074660	1.071079	0.975807

1.2.1 Overall Data Summary

Twenty-seven target compounds were identified in the 78 analyses. Benzene, m/p-xylene, toluene, ethylbenzene, styrene/o-xylene, carbon tetrachloride, and 1,1,1-trichloroethane were the most frequently identified compounds. Concentrations of the target compounds identified ranged from 0.01 ppbv for 1,1,2-trichloroethane to 88.90 ppbv for m/p-xylene. The overall average concentration of the target compounds identified was 2.28 ppbv.

1.2.2 Site Results

Overall site mean concentrations ranged from 0.92 ppbv for C3IL to 5.34 ppbv for C6IL for the target compounds identified. These data are presented in Section 7.0.

1.2.3 Gas Chromatography/Mass Spectrometry Confirmation Results

Fourteen 3-hour air toxics ambient air samples were analyzed by Gas Chromatography/Mass Spectrometry (GC/MS) for compound identification confirmation of the GC/MD analyses. The GC/MS analyses were performed after the GC/MD analyses. The GC/MS analyses confirmed 93.9% of the GC/MD analyses.

For the 3-hour air toxics samples the negative GC/MD-positive GC/MS analyses were 3.57 percent. The positive GC/MD-negative GC/MS analyses were 2.52 percent.

1.2.4 Precision

Sampling and analytical precision of 3-hour air toxics samples was estimated by analyzing duplicate samples. In terms of overall average absolute percent difference, the sampling and analysis precision was 8.72 percent.

Analytical precision was estimated by repeated analyses of seven duplicate samples. The analytical precision measured by the overall average absolute percent difference was 9.12 percent. Both the sampling and analytical precision results are excellent in view of the concentration range found in this study.

The data analyses showed that both for the duplicate and replicate results, the imprecision was significantly higher at concentrations less than 2 ppbv. Both the duplicate sample and repeated analyses results are discussed in Section 8.0.

1.2.5 External Audit

UATMP External Audit Sample No. 3 was received from the EPA-QAD and analyzed prior to the analyses of the 3-hour air toxics samples. The sample was analyzed by both the GC/MD and the GC/MS analytical systems. An average bias of 0.84% was found for the GC/MD analyses and an average bias of -20.5% was found for the GC/MS analyses. In view of the fact that the GC/MS analyses were used as a qualitative screening tool for compound identification confirmation (and not for quantitation), these are excellent results and well within the data quality objectives of the program.

2.0 NMOC DATA SUMMARY

This section presents the data summary for the 1989 NMOC Monitoring Program conducted during June, July, August, and September. Daily NMOC concentrations and other pertinent monitoring data are given by site in Appendix C. The majority of the data presented in this section summarize the NMOC concentrations measured for samples collected at 23 sites throughout the continental United States. Sites were selected in urban and/or industrial locations; they are described in Appendix A. The site codes for the 1989 NMOC Monitoring Program are listed in Appendix A and are used throughout the report to identify the sites. Samples were collected in 6-liter (L) stainless steel canisters by local site operators trained by Radian Corporation personnel. The sampling procedure was described in detailed written instructions and given to the site operators. The sampling procedure instructions also appear in Section 3.1.2. Analytical concentration measurements of NMOC were made in the Radian Corporation Research Triangle Park (North Carolina) laboratory according to the PDFID method TO-12.[1] The complete procedure is described in Appendix B.

The concentration of oxides of nitrogen (NO_x), site temperature, barometric pressure, wind direction, and weather conditions were provided on the field sampling forms by site personnel at the time of sampling. These data were recorded in the 1989 NMOC data base, but are not presented in this report because they were not measured by Radian equipment or personnel, nor were the data subjected to project quality assurance procedures.

Table 2-1 lists the NMOC Monitoring Program completeness results by site code. The scheduling of sample days and the scheduling of duplicate analyses is given in the QAPP.[2] One site, ELTX (El Paso, TX), produced over 100% completeness by taking an unscheduled duplicate in addition to all other scheduled samples. For the remainder of the 1989 NMOC sites, completeness was over 80%, and generally very near to 100 percent. A complete listing of invalid samples and the reasons for the invalidation are given in Appendix D.

Overall completeness figures for the 1989 NMOC Program show 95.5% complete. This compares with 93.4% in 1988, 95.0% complete in 1987, 96.8% complete in 1986, 95.8% complete in 1985 and 90.6% complete in 1984.[2,3,4,5]

TABLE 2-1. 1989 COMPLETENESS RESULTS

Radian Site Code Complete	Scheduled Sampling Days	Total Scheduled Duplicate Samples	Total Scheduled Samples	Total Valid Duplicate Samples	Total Valid Samples	Percent
ALCA	83	8	91	11	89	97.80
BACA	83	8	91	10	83	91.21
BMTX	83	8	91	10	90	98.90
C3IL	83	8	91	8	84	92.31
C6IL	83	8	91	7	85	93.41
DLTX	83	8	91	8	91	100.00
ELCA	83	8	91	7	85	93.41
ELTX	83	8	91	8	92	101.10
FECA	83	8	91	8	87	95.60
GRMI	83	8	91	7	88	96.70
H1TX	82	8	90	9	83	92.22
LBCA	67	8	75	7	71	94.67
LXKY	83	8	91	9	91	100.00
M1NY	82	8	90	9	89	98.89
MGAL	83	8	91	8	86	94.51
NMY	83	8	91	8	85	93.41
NWNJ	83	8	91	8	88	96.70
PLNJ	83	8	91	10	87	95.60
RLNC	83	8	91	7	90	98.90
RSCA	59	7	66	9	59	89.39
S2MO	82	8	90	8	88	97.78
S3CA	83	8	91	10	79	86.81
S4CA	83	8	91	8	86	94.51
Overall	1866	183	2049	194	1956	95.46

Completeness was defined as the percentage of samples, scheduled in the QAPP,[1] that were collected and analyzed as valid samples, beginning with the first valid sample and ending with the last scheduled sample.

Table 2-2 summarizes statistics by sites into three classifications, Morning Site, Late Morning Site, and Above-300-m-Altitude site. "Morning Sites" were those where an integrated sample was collected from 6:00 a.m. to 9:00 a.m. "Late Morning Site" collected samples 9:00 a.m. to noon. The "Above 300-m-Altitude Site" collected ambient air samples from 6:00 a.m. to 9:00 a.m. at an altitude above 300 meters from ground level. Morning and Late Morning Site samples were collected at 3 to 10 meters above ground level. The subclassifications of the NMOC monitoring sites were made because the mean NMOC values were expected[3] to be different in the Morning and Late Morning Sites, and at the higher elevations above ground level. It is not known whether the difference between the Morning Sites and the Late Morning Sites is because of their locations, because of the difference in time of the collection of the sample, or both.

The overall average of the Morning Site NMOC concentration is seen to be 0.577 ppmC, while the Late Morning Site NMOC concentration average is 0.158 ppmC, about 27% of the morning concentration average. The higher altitude site averaged 0.267 ppmC, only 46% of the morning concentration average. The averages given here are not intended to be characteristic of all possible sites, sampling times, or altitudes. The averages pertain only to the sites for the 1989 Monitoring Program.

In Table 2-2, the means are the arithmetic averages of the NMOC concentrations at each site. The numbers given for standard deviation, skewness, and kurtosis are the second, third, and fourth moments, respectively about the arithmetic means. A skewness value greater than zero applies to distributions having a longer tail to the right. A distribution that is normally distributed would have a kurtosis of 3.0. A distribution more peaked (or pointed) than a normal distribution, having the same variance, would have a kurtosis greater than 3.0.

NMOC monitoring data can be better characterized by a lognormal distribution than by a normal distribution, following the findings of previous years.[3,4,5,6,7] Table 2-3 summarizes the 1989 NMOC data using the definitions

TABLE 2-2. 1989 NMOC SITE STATISTICS

Radian Site Code	NMOC, ppmC						
	Minimum	Median	Mean	Maximum	Standard Deviation	Skewness	Kurtosis
Morning Sites (Sampling 6:00 to 9:00 a.m., local time)							
BACA	0.150	0.799	0.809	2.499	0.409	0.917	2.185
BMTX	0.220	0.655	0.830	4.047	0.631	2.880	10.367
C6IL	0.126	0.764	0.851	2.663	0.506	1.233	2.013
DLTX	0.114	0.421	0.474	1.612	0.285	1.548	3.111
ELCA	0.088	0.305	0.452	1.733	0.366	1.644	2.260
ELTX	0.093	0.381	0.498	2.442	0.402	2.375	6.917
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GRMI	0.203	0.517	0.641	1.880	0.387	1.234	0.739
H1TX	0.180	0.632	0.791	2.614	0.479	1.251	1.639
LBCA	0.242	0.697	0.881	2.855	0.573	1.606	1.922
LXKY	0.082	0.270	0.377	1.796	0.342	2.547	6.574
M1NY	0.211	0.527	0.601	2.043	0.336	1.935	5.180
MGAL	0.087	0.192	0.221	1.133	0.156	4.299	21.667
MNY	0.127	0.515	0.555	1.609	0.286	1.222	1.819
NWNJ	0.158	0.519	0.652	3.693	0.539	2.944	11.375
PLNJ	0.073	0.407	0.529	1.796	0.384	1.354	1.316
RLNC	0.137	0.137	0.162	0.551	0.162	1.368	1.916
RSCA	0.210	1.113	1.224	3.993	0.796	1.278	1.666
S2MO	0.187	0.607	0.747	5.013	0.640	3.941	21.229
S3CA	0.075	0.205	0.310	2.452	0.340	3.920	19.325
S4CA	0.061	0.179	0.262	1.534	0.266	3.192	11.112
Overall	0.043	0.434	0.577	5.013	0.493	2.461	10.334
Late Morning Site (Sampling 9:00 a.m. to noon, local time)							
ALCA	0.037	0.117	0.158	0.867	0.151	3.560	12.838
Above-300-m-Altitude Site (Sampling 6:00 to 9:00 a.m., local time)							
C3IL	0.042	0.228	0.267	0.954	0.172	1.481	2.721

TABLE 2-3. 1989 NMOC LOGNORMAL STATISTICS

Radian Site Code	Logarithmic Normal Distribution of NMOC						
	Minimum	Mode	Median	Mean	Maximum	MU[a]	SIGMA[b]
Morning Sites (Sampling 6:00 to 9:00 a.m., local time)							
BACA	0.150	0.502	0.799	0.828	2.499	-0.356	0.577
BMTX	0.220	0.486	0.655	0.816	4.047	-0.376	0.588
C6IL	0.126	0.469	0.764	0.871	2.663	-0.344	0.643
DLTX	0.114	0.289	0.421	0.476	1.612	-0.908	0.577
ELCA	0.088	0.206	0.305	0.448	1.733	-1.061	0.719
ELTX	0.093	0.247	0.381	0.494	2.442	-0.936	0.677
FECA	0.124	0.252	0.371	0.514	2.491	-0.903	0.690
GRMI	0.203	0.401	0.517	0.638	1.880	-0.604	0.557
H1TX	0.180	0.468	0.632	0.795	2.614	-0.406	0.594
LBCA	0.242	0.550	0.697	0.871	2.856	-0.292	0.553
LXKY	0.082	0.188	0.270	0.365	1.796	-1.230	0.666
M1NY	0.211	0.419	0.532	0.598	2.043	-0.633	0.487
MGAL	0.087	0.158	0.192	0.216	1.133	-1.636	0.456
MNY	0.127	0.377	0.515	0.559	1.609	-0.713	0.512
NWNJ	0.158	0.357	0.519	0.638	3.693	-0.644	0.622
PLNJ	0.073	0.247	0.407	0.535	1.796	-0.882	0.717
RLNC	0.043	0.087	0.137	0.162	0.551	-2.026	0.644
RSCA	0.210	0.644	1.113	1.243	3.993	-0.002	0.663
S2MO	0.187	0.431	0.607	0.726	5.013	-0.494	0.589
S3CA	0.075	0.143	0.205	0.293	2.452	-1.467	0.689
S4CA	0.061	0.127	0.179	0.249	1.534	-1.615	0.670
Overall	0.043	0.228	0.434	0.583	5.013	-0.853	0.792
Late Morning Site (Sampling 9:00 a.m. to noon, local time)							
ALCA	0.037	0.092	0.117	0.150	0.867	-2.061	0.575
Above-300-m-Altitude Site (Sampling 6:00 to 9:00 a.m., local time)							
C3IL	0.042	0.144	0.228	0.271	0.954	-1.517	0.649

---

[a] MU is the mean of ln(NMOC). e^{MU} is the geometric mean.

[b] SIGMA is the standard deviation of ln(NMOC). e^{SIGMA} is called the geometric standard deviation.

that characterize a lognormal distribution overall and for each site. MU and SIGMA are the mean and standard deviation, respectively, of the logarithm of NMOC to the Napierian base e. The geometric mean is e raised to the power MU; the geometric standard deviation is e raised to the power SIGMA. The mode is the most frequently occurring logarithm of NMOC value for a continuous probability distribution function.

Information listed in Appendix A includes the location of the site, street address as well as the Universal Transverse Mercator (UTM) coordinates for the site (where available), the site code used throughout this report, the Storage and Retrieval of Aerometric Data (SAROAD) Number, and the Aerometric Information Retrieval System (AIRS) Number. Appendix A gives the AIRS printouts for all the sites that are in the system for 1989.

Appendix C gives the daily NMOC concentration data listed chronologically for the entire sampling season. In addition, figures are given for each site in which NMOC concentrations in ppmC are plotted versus the 1989 Julian date on which the sample was taken. Data tables for each site include the following:

- calendar date sampled;
- Julian date samples;
- weekday sample (M, T, W, H, F);
- sample ID number, assigned consecutively upon receipt of the sample;
- sample canister number;
- Radian analysis channel;
- NMOC concentration in ppmC, determined by Radian;
- NMOC concentration in ppmC, determined by U.S. EPA, Quality Assurance Division; and
- NMOC concentration in ppmC, determined by U. S. EPA, Atmospheric Research and Exposure Assessment Laboratory.

Appendix D lists invalidated or missing samples. Table D-1 lists these data chronologically, while Table D-2 groups the listings by site code. For each sample, the tables list the site code, the date of the missing or invalid sample, a brief description of the possible cause of the invalid or missing sample, and the assigned cause for the failure.

3.0 NMOC TECHNICAL NOTES

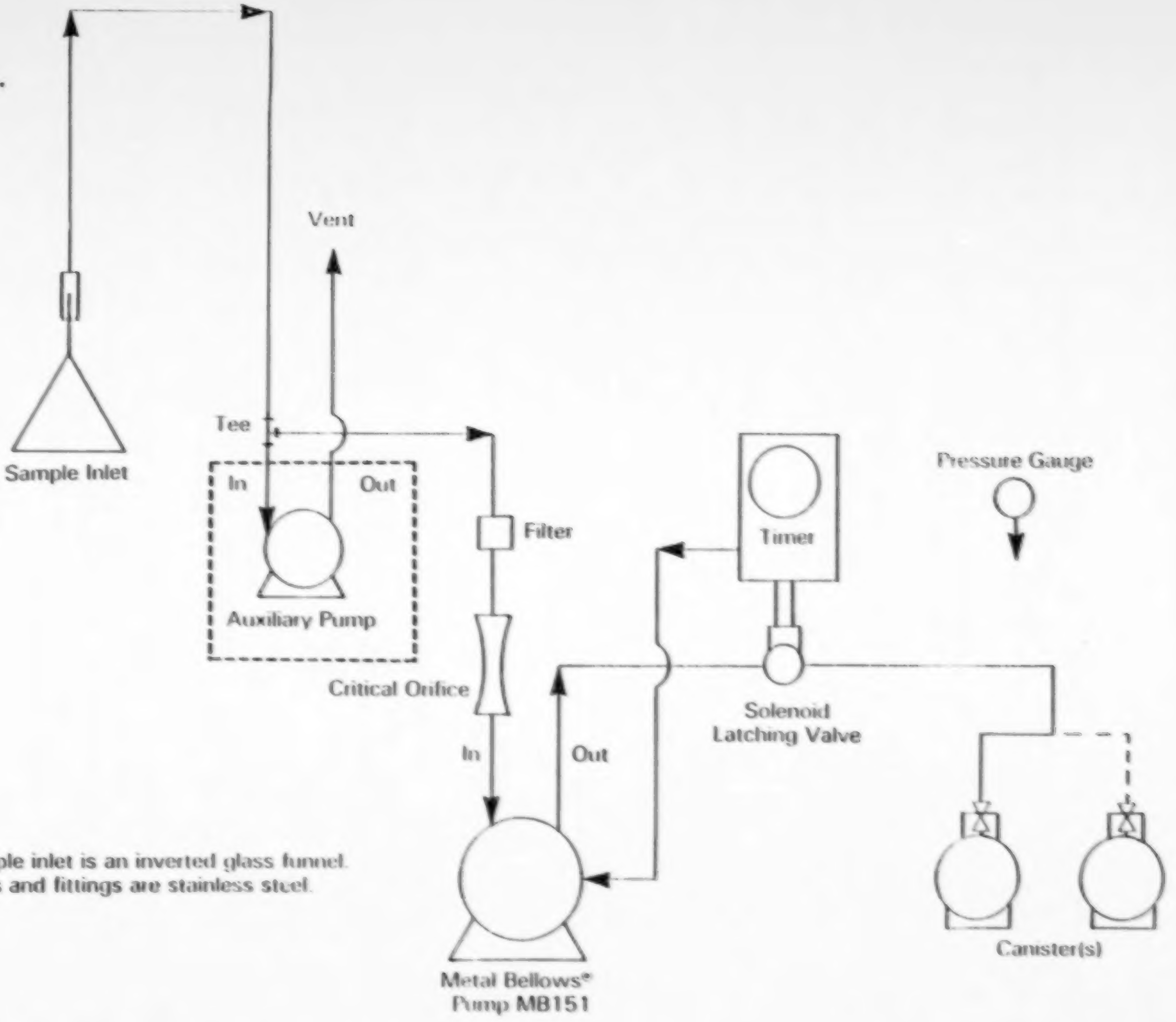
This section summarizes descriptions of the installation and operation of the field sampling equipment, a summary of the analytical equipment and procedures for NMOC measurement, and a description of the canister cleanup equipment and procedures.

3.1 NMOC FIELD SAMPLING EQUIPMENT

The field sampling equipment used to collect ambient air samples for NMOC measurement is relatively simple to operate. Ambient air is drawn through a sintered stainless steel filter (2 micron) and critical orifice by a Metal Bellows® pump and delivered to a SUMMA® canister. The sampler components are made of nonbiasing stainless steel. Figure 3-1 is a schematic diagram of the NMOC sampling system.

3.1.1 Installation

NMOC sampler installation configurations were site dependent. All field sites were installed by or under the direction of Radian personnel. Installation requirements included a temperature-controlled environment (70° to 86°F), close proximity to the atmosphere to be sampled, and noncontaminating sampler connections. Glass and/or gas-chromatographic-grade stainless steel tubing are the preferred materials of construction for all connections contacting the sample. Typical sampler installations involved three configurations including direct connections to a ventilated glass manifold, a slipstream connection prior to the station NO_x analyzer with a bypass pump, or collocated NMOC and NO_x sample inlet lines. For sites where the distance between the sample inlet and the stainless steel post was greater than 8 feet, an auxiliary pump, as shown in Figure 3-1, was used. The auxiliary pump helps ensure that the air in the sample line is representative of the ambient air. The critical orifice was sized to maintain a constant flow rate and to fill a 6-L stainless steel canister from the 5 mm Hg vacuum to about 15 psig in 3 hours. When duplicate samples were taken, the critical orifice used for single sample collection was replaced with an orifice sized to fill two canisters during the 3-hour sampling period.


Sample Inlet
Tee
In
Out
Auxiliary Pump
Vent
Filter
Critical Orifice
In
Out
Metal Bellows®
Pump MB151
Timer
Solenoid
Latching Valve
Pressure Gauge
Canister(s)

* Sample inlet is an inverted glass funnel.
Lines and fittings are stainless steel.

Figure 3-1. Sampling system for collecting 3-hour integrated ambient air samples.

3.1.2 Operation

Presampling

The following instructions pertain to the sampling operation prior to collection of the field sample.

1. Verify timer program (see timer instructions). Set to MANUAL position to leak check sampling system. Once the system passes the leak check, turn timer to AUTO position.

2. With no canisters connected to the sampling system, turn the timer switch to the MANUAL position.

3. Disconnect the sample inlet from the top of the orifice/filter assembly mounted on the pump inlet. Connect the rotameter to the top of the orifice/filter assembly. Tighten Swagelok* (1/4") fitting securely with a wrench. Do not overtighten.

4. Turn timer switch ON. Do not turn the power off and on rapidly. Wait 20 seconds between cycles to prevent premature timer/solenoid failure. The pump should run and the latching valve should open (audible click with 2 to 5 seconds delay). Verify that the rotameter reading is approximately the same (±15%) as the reading obtained during installation as recommended on the orifice tag. If the rotameter reading is not correct, see the troubleshooting instructions.

5. Allow the pump to run for at least 20 seconds, then press the timer OFF button.

6. Connect a cleaned, evacuated canister to the sampling system. If duplicate samples are to be collected, remove the plug from the second port of the tee and connect a second canister to the sampling system. Remove the orifice assembly marked with an "S," denoting a single orifice. Install the orifice assembly marked with a "D," denoting a double orifice. Replace the filter holder on the "D" orifice. After obtaining scheduled duplicate samples, replace the plug and the "S" orifice assembly to return to single sample collection status.

7. With the pump off, open completely the valve on the canister (or on one of the canisters if two are connected) and verify that no flow is registered on the rotameter. If any flow is detected by the rotameter, immediately close the canister valve and see the troubleshooting instructions.

8. If no flow is observed, disconnect the rotameter and reconnect the inlet sample line to the filter assembly. If two canisters are connected, completely open the valve on the second canister.

9. Reverify that the canister valve(s) is (are) completely open and the timer is properly set for sampling from 6 a.m. to 9 a.m. the next weekday. Set timer to AUTO mode.

10. Reset the elapsed time counter.

Postsampling

The instructions that follow outline the NMOC postsampling operation procedures in the field.

1. Close the canister valve(s) firmly. Disconnect the canister(s) from the sampling system.

2. Connect the pressure gauge to the canister inlet and open the canister valve. Record the canister pressure on the field sampling data form. Close the canister valve and remove the pressure gauge. Repeat pressure measurement for second canister if collecting a duplicate sample. If the pressure reading is not at least 11 psig, see the troubleshooting instructions.

3. Fill in the required information on the NMOC SAMPLING FIELD DATA FORM. PLEASE PRESS HARD AND WRITE WITH A BALLPOINT PEN: YOU ARE MAKING THREE COPIES. (see Figure 3-2).

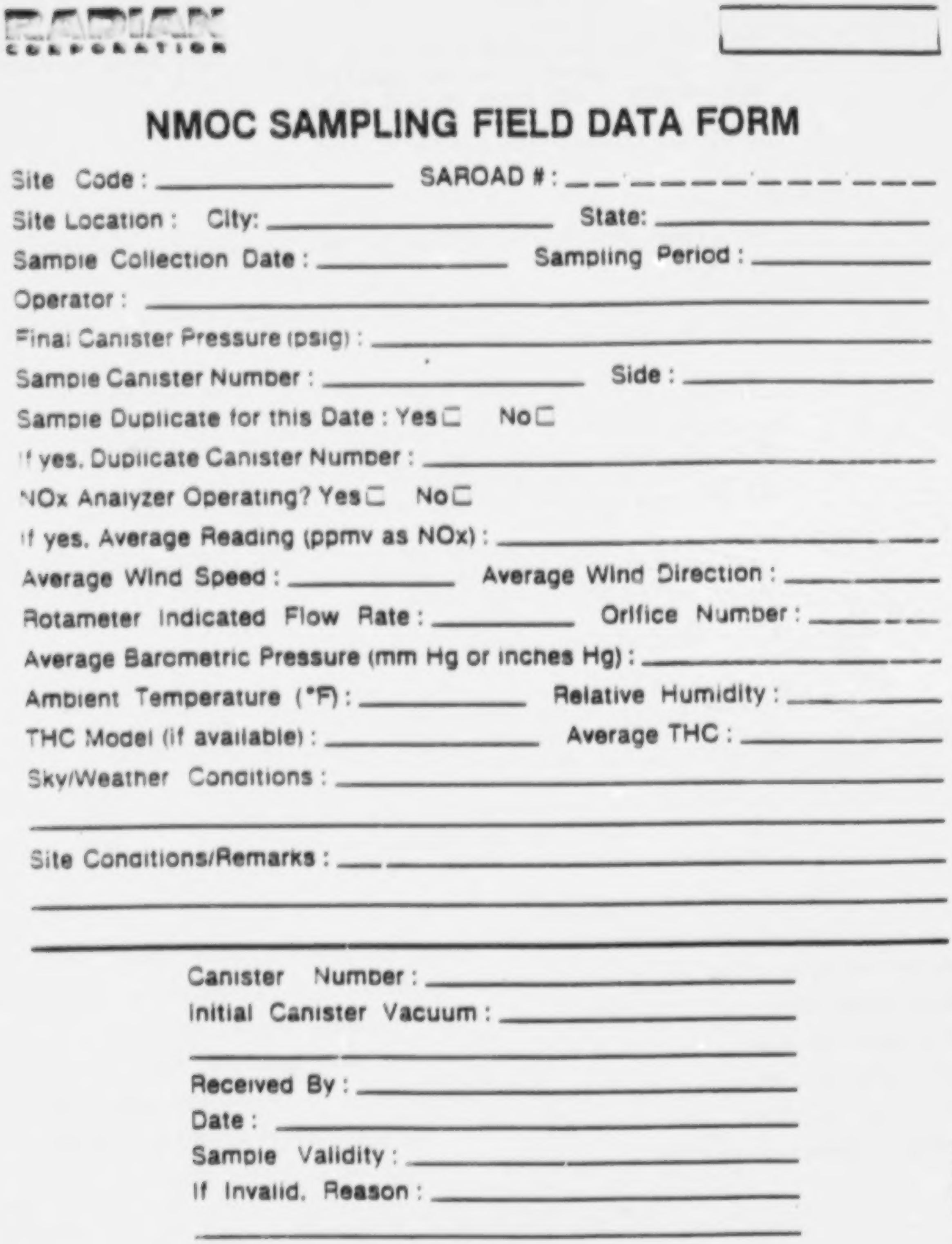
4. Verify elapsed time counter reading equals 3 hours.

5. Verify that the timer shows the correct time setting. If not, note that fact on the sample form along with any information pertaining to the possible cause. Reset the timer to the correct time, if necessary.

6. Verify that the canister valves are closed firmly. Do not overtighten them. Put the protective cap(s) on the valve(s) and prepare the canister(s) for shipment to Radian, RTP.

3.1.3 Troubleshooting Instructions

A list of troubleshooting instructions was given to each field site during the site installation and operator training. Typical problems encountered with the field sampling apparatus included: loose fittings, misprogrammed timer, or clogged orifices. To minimize downtime, field site operators were encouraged to relay sampling problems to the Radian laboratory daily, by telephone. Most sampling problems were addressed promptly through these telephone discussions.



RADIAN
CORPORATION

NMOC SAMPLING FIELD DATA FORM

Site Code : ____________ SAROAD # : __ __ - __ __ __ __ - __ __ __ - __ __ __

Site Location : City: ____________ State: ____________

Sample Collection Date : ____________ Sampling Period : ____________

Operator : ____________

Final Canister Pressure (psig) : ____________

Sample Canister Number : ____________ Side : ____________

Sample Duplicate for this Date : Yes ☐ No ☐

If yes, Duplicate Canister Number : ____________

NOx Analyzer Operating? Yes ☐ No ☐

If yes, Average Reading (ppmv as NOx) : ____________

Average Wind Speed : ____________ Average Wind Direction : ____________

Rotameter Indicated Flow Rate : ____________ Orifice Number : ____________

Average Barometric Pressure (mm Hg or inches Hg) : ____________

Ambient Temperature (°F) : ____________ Relative Humidity : ____________

THC Model (if available) : ____________ Average THC : ____________

Sky/Weather Conditions : ____________

Site Conditions/Remarks : ____________

Canister Number : ____________

Initial Canister Vacuum : ____________

Received By : ____________

Date : ____________

Sample Validity : ____________

If Invalid, Reason : ____________

388118GR

Figure 3-2. NMOC Sampling field data form.

3.1.4 Sampler Performance for 1989

The NMOC sampler was modified in 1989 to improve performance. This modification involved replacing the mechanical timer previously used with an electronic version. The electronic timer improves sample integration. An elapsed time counter was added to the sampler to verify sample duration. This modified system was used during the 1989 program. In addition, all sampler orifice(s) and canisters were subjected to a preseason QC check to ensure field performance. All orifices were checked against the rotameter enclosed in each sampling kit, and referenced to a transfer standard (bubble flowmeter). Prior to field installation, all samplers were operated in the laboratory to establish an expected final pressure range for the canister samples. Two single orifices and one double orifice were tested for each sampler kit.

Due to the preseason checks and modifications, the NMOC sampler performance was improved for the 1989 sampling season. This assessment is based on the consistency of the final sample pressures on a site-specific basis (see Section 4.6). The sampler performance in terms of successful sample collection (i.e., completeness) was comparable to previous years. Overall completeness from all sites averaged 95.5 percent. The site-specific completeness ranged from 86.5% for S3CA to 101.1% for ELTX.

Invalidated or missing samples were primarily due to the operator or the site rather than to equipment. Completeness can be improved at certain sites through greater attention to sampling procedure, and by ensuring that trained site personnel are available. Those samples that were invalidated due to equipment failure were assigned to three major categories: timer, canister, and miscellaneous.

A total of 93 missing or invalidated samples was recorded in the 1989 NMOC Monitoring Program. There were nine invalidated samples related to timer problems, 12 invalidated samples related to canister problems, and 83 remaining invalidated samples. Appendix D lists a total of 86 invalidated samples. In addition to invalidated samples there were seven missed samples. Missed samples resulted from a number of problems at the site -- the operator was locked out of the sampling station, a site operator was not available on the day the sample was to be collected, etc. Avoidable operator error accounts for 43.0% of invalidated samples. No invalid samples were attributable to timer malfunctions. The operator's failure to open the canister valve accounted for 91.7% of the canister-related invalidated samples, and 8.3% were attributable to canister leaks. Of the remaining 83 invalidated samples, 45.8% were caused by loose or broken sample lines, or leaking solenoid valves; 54.2% were attributable to missed samples, power outages, or consecutive samples collected into the same canister. A listing of invalidated or missing samples is contained, chronologically and by site, in Appendix D.

A further improvement in completeness may be possible as site operators gain familiarity with the electronic timer. Revised sampler operating instructions will focus additional attention on timer programming and operation, and will include a daily checklist to eliminate common operator errors.

3.1.5 Field Documentation

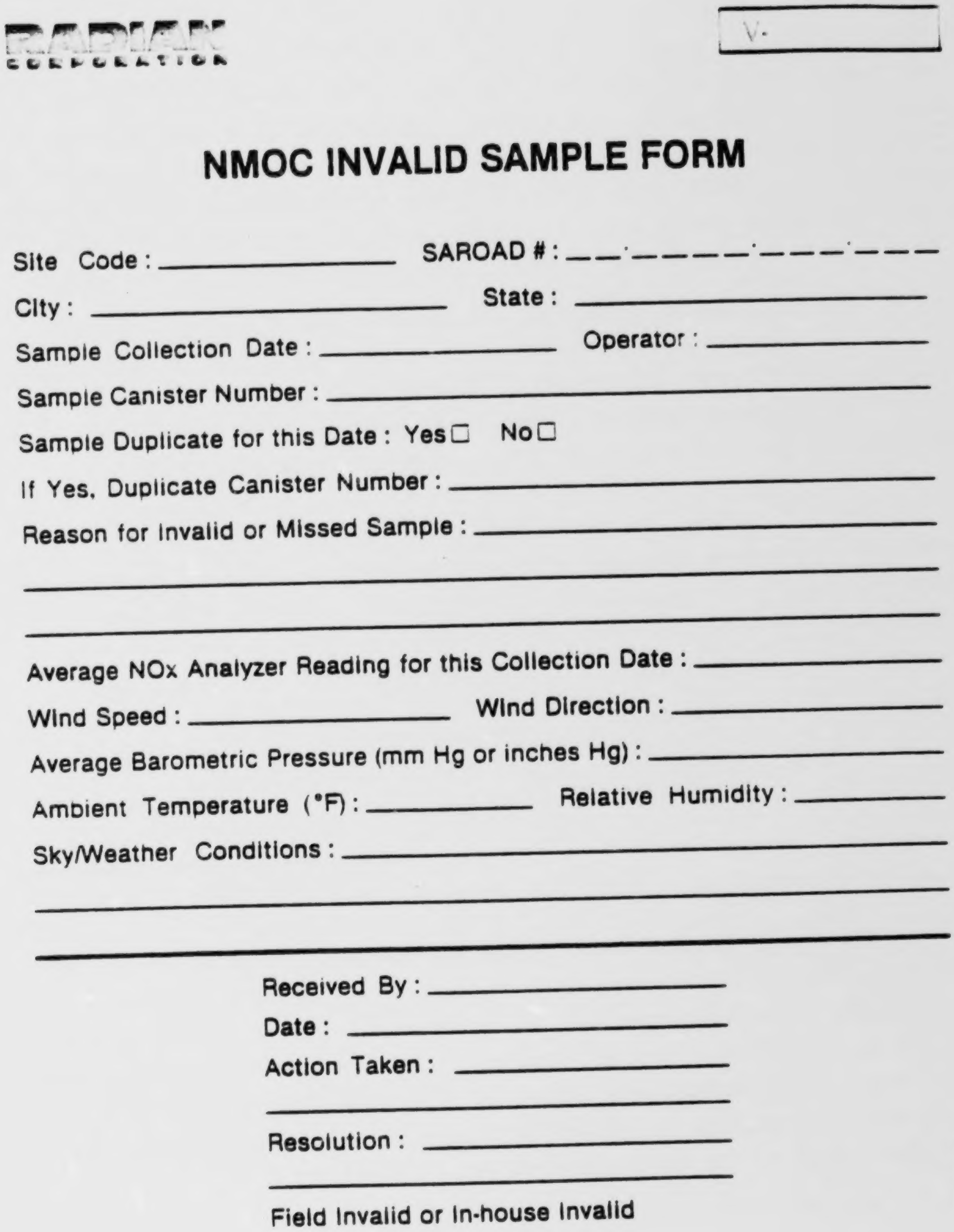
The field sample collection information was documented by the site operator on printed forms. Figure 3-2 is an example NMOC Sampling Field Data Form. Each canister sent to the field was accompanied by this form. The field data form is a multiple part unit. A copy of the field data form was retained by the site operator for the site notebook. Figure 3-3 is the Invalid Sample Form. This form was completed by the site operator to document the reasons for a missed or invalid field sample collections.

3.2 NMOC ANALYSIS

The NMOC analysis equipment and analysis procedure are described in greater detail in Appendix A. A brief description of the equipment and operating procedure used in this study follows.

3.2.1 Instrumentation

Two gas chromatographs were used by Radian. Each was a dual-channel Hewlett-Packard Model 5880 (HP-5880) using flame ionization detection (FID). NMOC instrument Channels A and B refer to the two FIDs on one HP-5880 unit, and Channels C and D refer to the two FIDs on the other HP-5880 unit. These chromatographs were modified to be similar to the prototype unit (EPA-QAD



RADIAN CORPORATION

V-

NMOC INVALID SAMPLE FORM

Site Code : ____________ SAROAD # : __-_____-___-___
City : ____________ State : ____________
Sample Collection Date : ____________ Operator : ____________
Sample Canister Number : ____________
Sample Duplicate for this Date : Yes ☐ No ☐
If Yes, Duplicate Canister Number : ____________
Reason for Invalid or Missed Sample : ____________

Average NOx Analyzer Reading for this Collection Date : ____________
Wind Speed : ____________ Wind Direction : ____________
Average Barometric Pressure (mm Hg or inches Hg) : ____________
Ambient Temperature (°F) : ____________ Relative Humidity : ____________
Sky/Weather Conditions : ____________

Received By : ____________
Date : ____________
Action Taken : ____________
Resolution : ____________
Field Invalid or In-house Invalid

3881188R

Figure 3-3. NMOC Invalid sample form.

instrument), which is described in Appendix B. The EPA-QAD instrument was used as a reference during this program. In addition, an HP-5880 gas chromatograph located at EPA and equipped with a 60 m x 0.32 mm inside diameter (i.d.), DB-1, fused silica capillary column was used as the gas speciation method and as a quality assurance check. This capillary column instrument is called EPA-ASRL channel in subsequent sections of this report.

3.2.2 Hewlett-Packard, Model 5880, Gas Chromatograph Operating Conditions

The sample trap consisted of 30 cm of 1/8-inch outside diameter (o.d.) stainless steel tubing, packed with 60/80 mesh glass beads.

Three support gases were used in this analysis: helium, hydrogen, and hydrocarbon-free air. Details of their use are given below in Table 3-1.

TABLE 3-1. SUPPORT GAS OPERATING CONDITIONS

Purpose	Cylinder Composition	Pressure	Mean Flow Rate[a]
Carrier Gas	Helium	30 psig	29.4 mL/min
FID Air	Hydrocarbon-free air	30 psig	300.1 mL/min
FID Fuel	Hydrogen	32 psig	31.1 mL/min

[a] Flow rates corrected to standard conditions (1 atmosphere pressure, 20°C).

The operating temperatures of the HP-5880 were controlled for the NMOC analysis. The FID and auxiliary area were controlled at 250°C and 90°C, respectively. The oven temperature was programmed from 30°C to 90°C at a rate of 30°C per minute for 4 minutes, holding at 90°C for the fourth minute. Oven and integration parameters were controlled by HP Level 4 programmable integrators. A complete listing of the integrator programming sequence for NMOC measurement by the PDFID method is given in Appendix E.

3.2.3 NMOC Analytical Technique

The modified HP-5880, dual-FID chromatographs were operated during the 1989 study according to a project specific Standard Operating Procedure (SOP).

Further description is given below to help explain the analytical apparatus and procedure.

The six-port valve shown in Figure 3-4 was installed in the auxiliary heated zone of the HP-5880 and was pneumatically actuated using chromatographic valve control signals to apply either compressed air or vacuum to the valve. The sample trap itself was located inside the chromatograph's column oven. A section of 1/16-inch o.d. stainless steel tubing was sized to a length that prevented pressure and flow surges from extinguishing the FID flame. This length was determined experimentally and differs for each chromatograph and for each channel within chromatographs. Although the length of tubing effectively substitutes for the pressure restriction provided by a column, it does not perform the separation function of a column.

During sample trapping, a slight excess of sample gas flow was maintained. A pressure change of 80 mm Hg in a 1.7-L vacuum reservoir was used to gauge and control the volume of sample gas cryogenically trapped. After the trapping cycle was complete, the HP-5880 program shown in Appendix B was initiated. When the program triggered a horn emitting an audible beep, the cryogen was removed from the trap and the oven door was closed. The chromatographic program then assumed control of raising the oven temperature, at the preset rate, to release the trapped sample to the FID, and set up the integration parameters.

3.3 CANISTER CLEANUP SYSTEM

A cleanup cycle consisted of first pulling a vacuum of 5 mm Hg absolute pressure in the canister, followed by pressurizing the canister to 20 psig with cleaned, dried air that had been humidified. This cycle was repeated two more times during the canister cleanup procedure. The cleanness of the canister was qualified by PDFID analysis. Upon meeting the cleanness criterion, the canister was evacuated to 5 mm Hg absolute pressure a fourth time, in preparation for shipment to the site.

3.3.1 Canister Cleanup Equipment

A canister cleanup system was developed and used to prepare sample canisters for reuse after analysis. A diagram of the system is shown in Figure 3-5. An oil-free compressor with a 12-gallon reservoir provided source

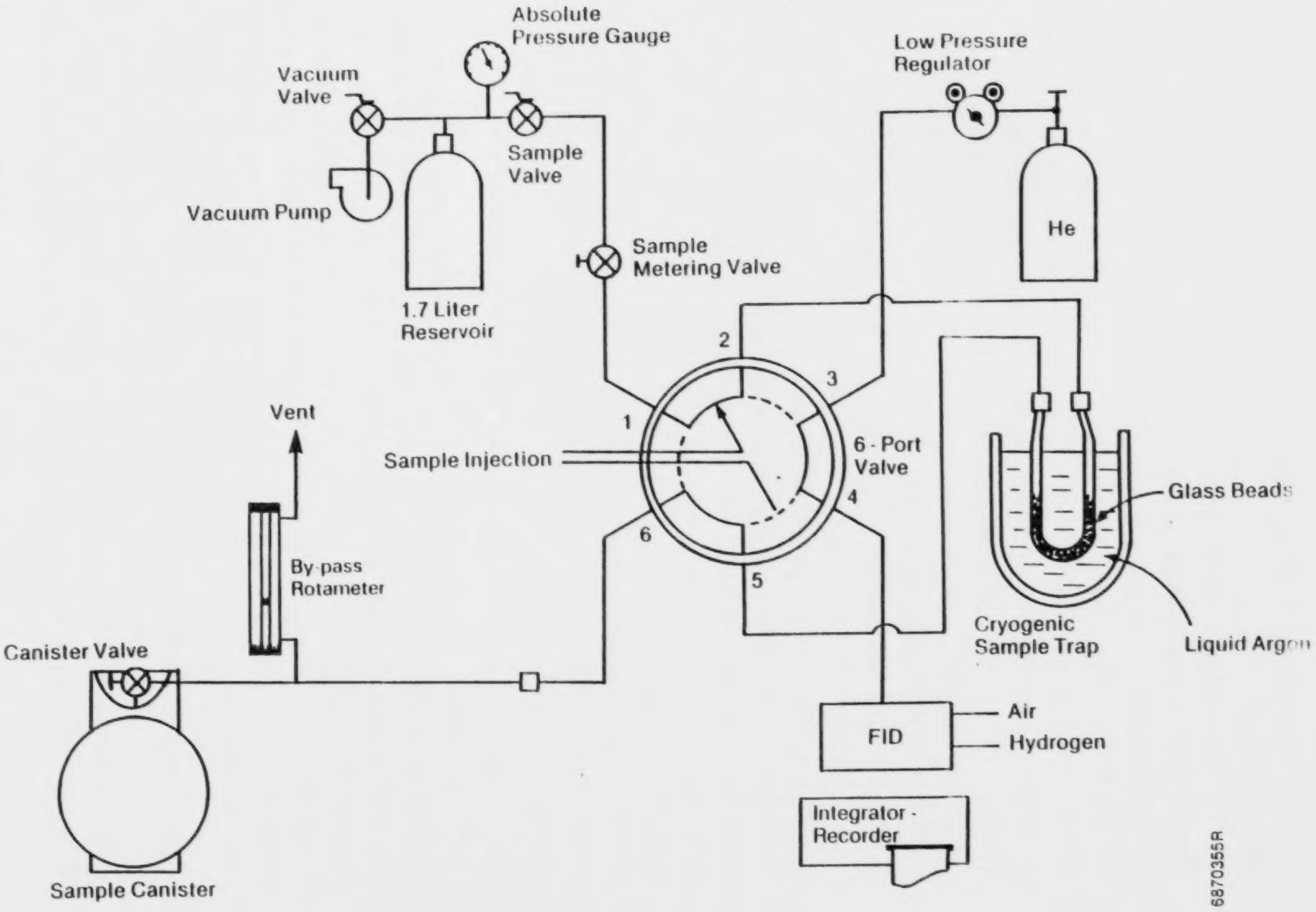
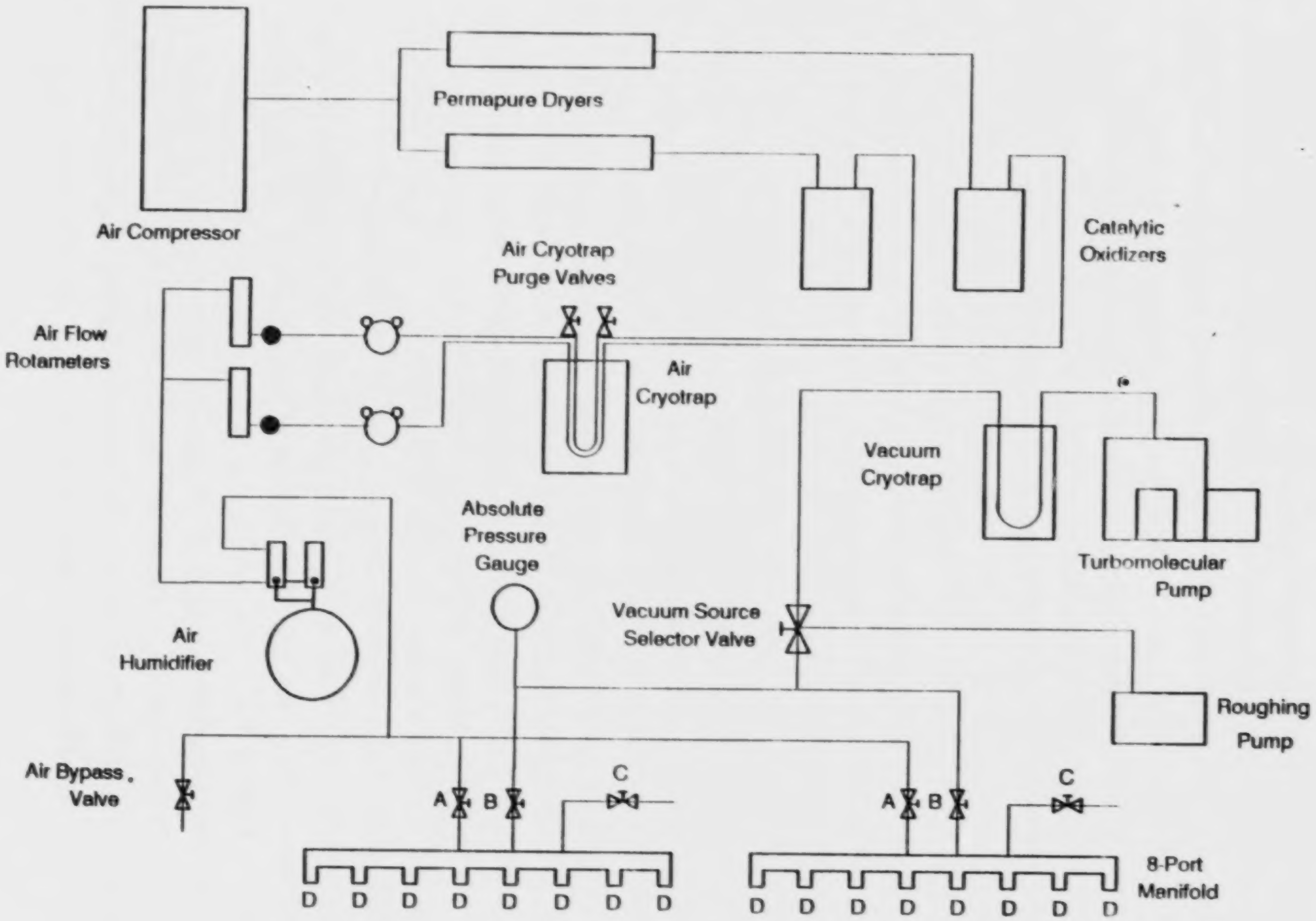

Absolute Pressure Gauge
Vacuum Valve
Sample Valve
Vacuum Pump
Sample Metering Valve
1.7 Liter Reservoir
Low Pressure Regulator
He
2
3
1
6 - Port Valve
4
6
5
Vent
Sample Injection
By-pass Rotameter
Glass Beads
Cryogenic Sample Trap
Liquid Argon
Canister Valve
Sample Canister
FID
Air
Hydrogen
Integrator - Recorder
6870355R

Figure 3-4. NMOC analytical equipment.


Air Compressor
Permapure Dryers
Catalytic Oxidizers
Air Cryotrap Purge Valves
Air Flow Rotameters
Air Cryotrap
Vacuum Cryotrap
Turbomolecular Pump
Absolute Pressure Gauge
Air Humidifier
Vacuum Source Selector Valve
Roughing Pump
Air Bypass Valve
A
B
C
A
B
C
D
D
D
D
D
D
D
D
D
D
D
D
D
D
D
D
8-Port Manifold

A. Manifold Air Pressure Valve
B. Manifold Vacuum Valve
C. Manifold Pressure Release Valve
D. Manifold Port for Connecting Canisters to be Cleaned

Figure 3-5. Canister cleanup apparatus.

air for the system. The oil-free compressor was chosen to minimize hydrocarbon contamination. The compressor reservoir was drained of condensed water each morning. A coalescing filter provided water mist and particulate matter removal down to a particle size of one micron. Permeation dryers removed water vapor from the compressor source air. These permeation dryers were followed by moisture indicators to show detectable moisture in the air leaving the dryer. The moisture indicators never showed any water, indicating that the permeation dryers effectively removed all of the water vapor.

Air was then passed through catalytic oxidizers to destroy residual hydrocarbons. The oxidizers were followed by inline filters for secondary particulate matter removal, and by a cryogenic trap to condense any water formed in the catalytic oxidizers and any organic compound not destroyed by the catalytic oxidizer. A single-stage regulator controlled the final air pressure in the canisters and a metering valve was used to control the flow rate at which the canisters were filled during the cleanup cycle. The flow was indicated with a rotameter installed in the clean, dried air line. There was a shutoff valve between the rotameters and the humidifier system. The humidifier system consisted of a SUMMA® treated 6-L canister partially filled with high performance liquid chromatographic-grade (HPLC-grade) water. One flowmeter and flow-control valve routed the cleaned dried air into the 6-L canister where it was bubbled through the HPLC-grade water. A second flow-control valve and flowmeter allowed air to bypass the canister/bubbler. By setting the flow-control valves separately, the downstream relative humidity was regulated. For the 1989 study, 80% relative humidity was used for canister cleaning. There was another shutoff valve between the humidifier and the 8-port manifold where the canisters were connected for cleanup.

The vacuum system consisted of a Precision Model DD-310 turbomolecular vacuum pump, a cryogenic trap, an absolute pressure gauge, and a bellows valve connected as shown in Figure 3-5. The cryogenic trap prevented the sample canisters from being contaminated by back diffusion of hydrocarbons from the vacuum pump into the cleanup system. There are no oil-free high vacuum pumps currently available at a competitive cost. The bellows valves enabled isolation of the vacuum pump from the system without shutting off the vacuum pump.

3.3.2 Canister Cleanup Procedures

After NMOC analyses were completed, a bank of eight canisters was connected to each manifold shown in Figure 3-5. The valve on each canister was opened, with the shutoff valves and the bellows valves closed. The vacuum pump was started and one of the bellows valves was opened, drawing a vacuum on the canisters connected to the corresponding manifold. After reaching 5 mm Hg absolute pressure as indicated by the absolute pressure gauge, the vacuum was maintained for 30 minutes on the eight canisters connected to the manifold. The bellows valve was then closed and the cleaned, dried air that had been humidified was introduced into the evacuated canisters until the pressure reached 20 psig. The canisters were filled from the clean air system at the rate of 7.0 L/min. This flow rate was recommended by the manufacturer as the highest flow rate at which the catalytic oxidizers could handle elimination of hydrocarbons with a minimum 99.7% efficiency.

When the first manifold had completed the evacuation phase and was being pressurized, the second manifold was then subjected to vacuum by opening its bellows valve. After 30 minutes, the second manifold was isolated from the vacuum and connected to the clean, dried air that had been humidified. The first manifold of canisters was then taken through a second cycle of evacuation and pressurization. Each manifold bank of eight canisters was subjected to three cleanup cycles.

During the third cleanup cycle, the canisters were pressurized to 20 psig with clean, dried air that had been humidified. For each bank of eight canisters, the canister having the highest precleanup NMOC concentration was selected for NMOC analysis to determine potential hydrocarbon residues. If the analysis measured less than 0.030 ppmC, then the eight canisters on the manifold were considered to be clean. Finally the canisters were again evacuated to 5 mm Hg pressure absolute; they were capped under vacuum and then packed in the containers used for shipping to the field sites.

4.0 NMOC QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES

This section details the steps taken in the 1989 NMOC Monitoring Program to ensure that the data taken were of known quality and were well documented. Analysis results are given in terms of precision, completeness, and accuracy. Repeated analyses provided analytical precision. Duplicate samples provided sampling and analysis precision. Completeness was measured in terms of percent of scheduled samples that resulted in valid samples, beginning with the first valid site-specific sample collected and ending with the last scheduled site-specific sample. Accuracy of NMOC concentrations was reported as percent bias of audit samples referenced to an NIST SRM propane by EPA-QAD.

4.1 INTRODUCTION AND CONCLUSIONS

Completeness for the 1989 NMOC study was 95.5 percent. This value indicates that good communication and planning were maintained between the site personnel and the laboratory personnel. Precision for the 1989 NMOC study averaged 14.2% absolute percent difference of repeated analysis and compared to 10.1% for the 1988 study, 9.61% for the 1987 study, 9.01% for the 1986 study, and 10% for the 1985 study. The absolute percent difference in 1989 was higher than in previous years and probably related to the fact that the overall average NMOC concentration for 1989 was lower than in previous years. For smaller values of NMOC concentrations, imprecision increases.

Bias of the Radian channels for the 1989 audit results ranged from +1.3% to +4.5 percent. In 1987 the accuracy determined from the external audit samples ranged from -2.9% to -0.06% and from 1.3% to 4.5% in 1988. In 1986 bias ranged from -0.52% to -3.3% and in 1985 bias ranged from -2.3% to +5.2 percent.

An initial multipoint performance evaluation was done with propane responses for each Radian channel. Twice daily calibration checks and daily in-house propane QC samples monitored instrument and operator performance. Duplicate site samples showed good overall sampling and analysis precision.

Data validation was performed on 14.5% of the 1989 NMOC data base, as described later in this section.

Calibration and drift determinations showed that the instrumentation was stable and that the calibration procedures were consistent. Canister cleanup results showed there was negligible carryover from one sample to the next. In-house QC samples of propane demonstrated that the analytical systems were in control.

Precision, accuracy, and completeness results for 1989 are compara to results from previous years and indicate that the data quality are good and meet all of the data quality objectives of the QAPP.[2]

4.2 CALIBRATION AND INSTRUMENT PERFORMANCE

Initial performance assessments for NMOC were conducted with propane. Daily calibrations were checked with about 3.0 ppmC propane for the NMOC measurements.

4.2.1 Performance Assessment

An initial performance assessment was done on each Radian channel, using propane certified by EPA-QAD. EPA-QAD referenced the certified propane to an NIST SRM No. 1666B propane. The concentration of the propane used in the performance assessment ranged from 0.117 to 17.559 ppmC. The "zero" value was determined using cleaned, dried air from the canister cleanup system described in Section 3.0. Table 4-1 summarizes the performance assessments below. The FID responses for propane are linear, having coefficients of correlation from 0.999742 to 0.999998. Figures 4-1 through 4-4 show plots of the NMOC performance results for Radian Channels A, B, C, and D, respectively. The plots show the regression line.

4.2.2 Calibration Zero, Span, and Drift

Radian PDFID channels were tested twice daily for zero and span. Zero readings were measured using cleaned, dried air. The zero air was supplied by the same system that cleans air for the canister cleanup system. Span readings used a mixture of about 3.0 ppmC propane in dry air. Calibration factors were calculated from the span and zero readings for each Radian channel. Initial calibration factors were determined in the morning before any site samples were analyzed and final calibration factors were determi in the afternoon after all the ambient air samples had been analyzed. Per

TABLE 4-1. 1989 PERFORMANCE ASSESSMENT SUMMARY, RADIAN CHANNELS

		Linear Regression Results[a]		
Radian Channel	Cases	Intercept	Slope	Coefficient of Correlation
A	5	1.0327	3283.350	0.999998
B	5	5.0703	3245.779	0.999944
C	5	-0.6076	3270.644	0.999916
D	5	0.4108	3271.665	0.999742

[a] Figures 4-1 through 4-4 plot propane area counts vs. concentration in ppmC.

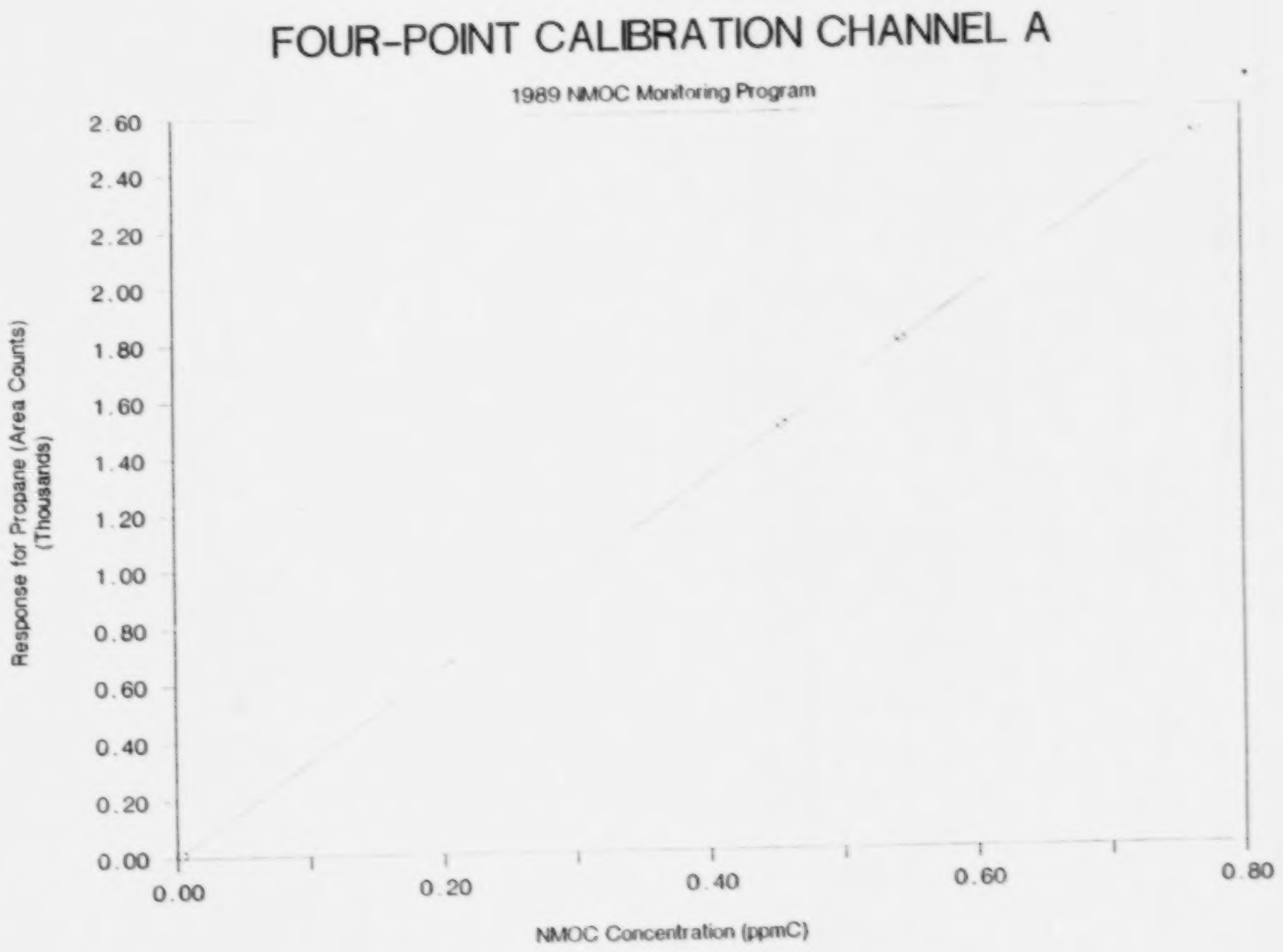


Figure 4-1. NMOC performance results, Channel A.

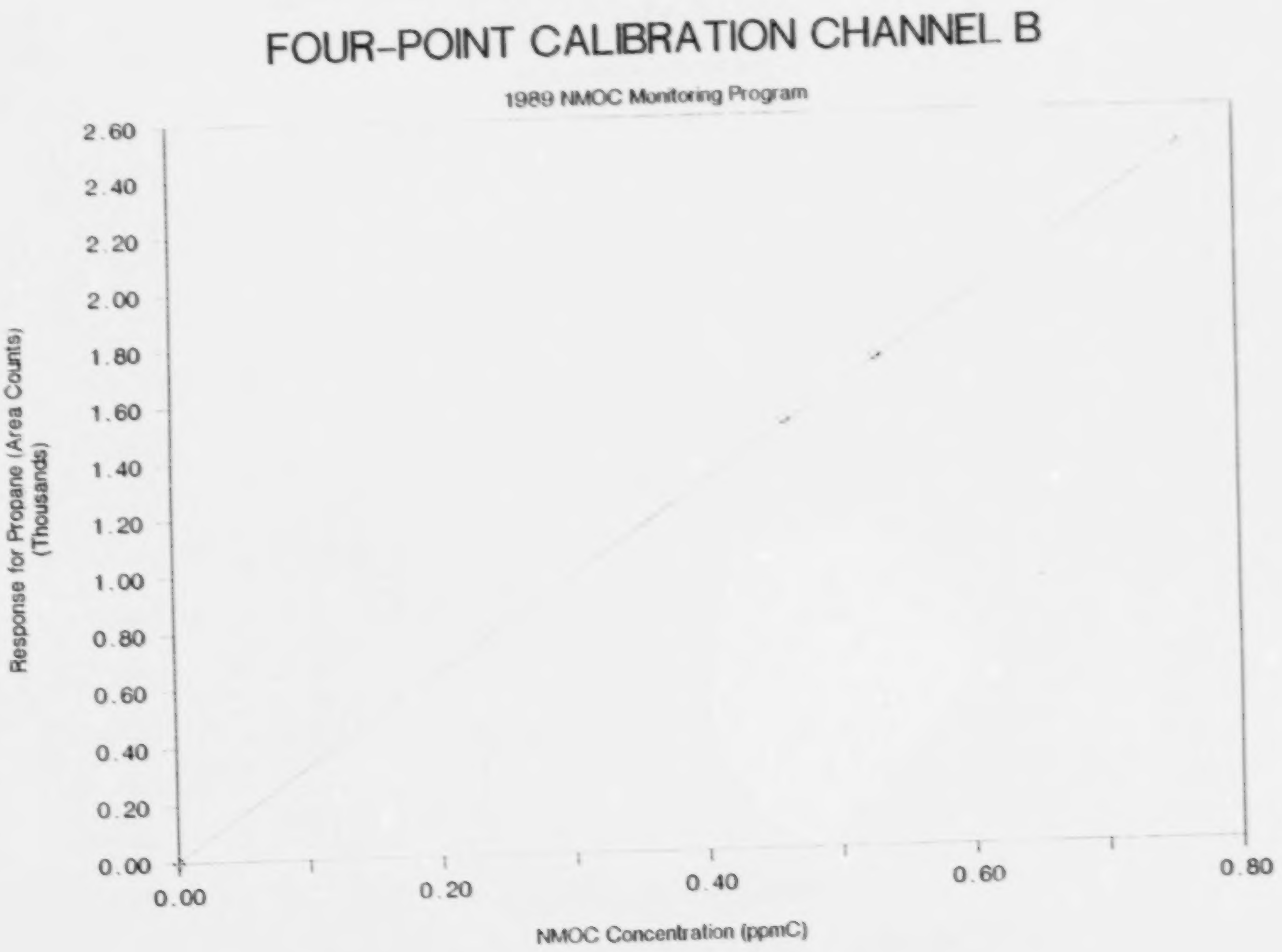


Figure 4-2. NMOC performance results, Channel B.

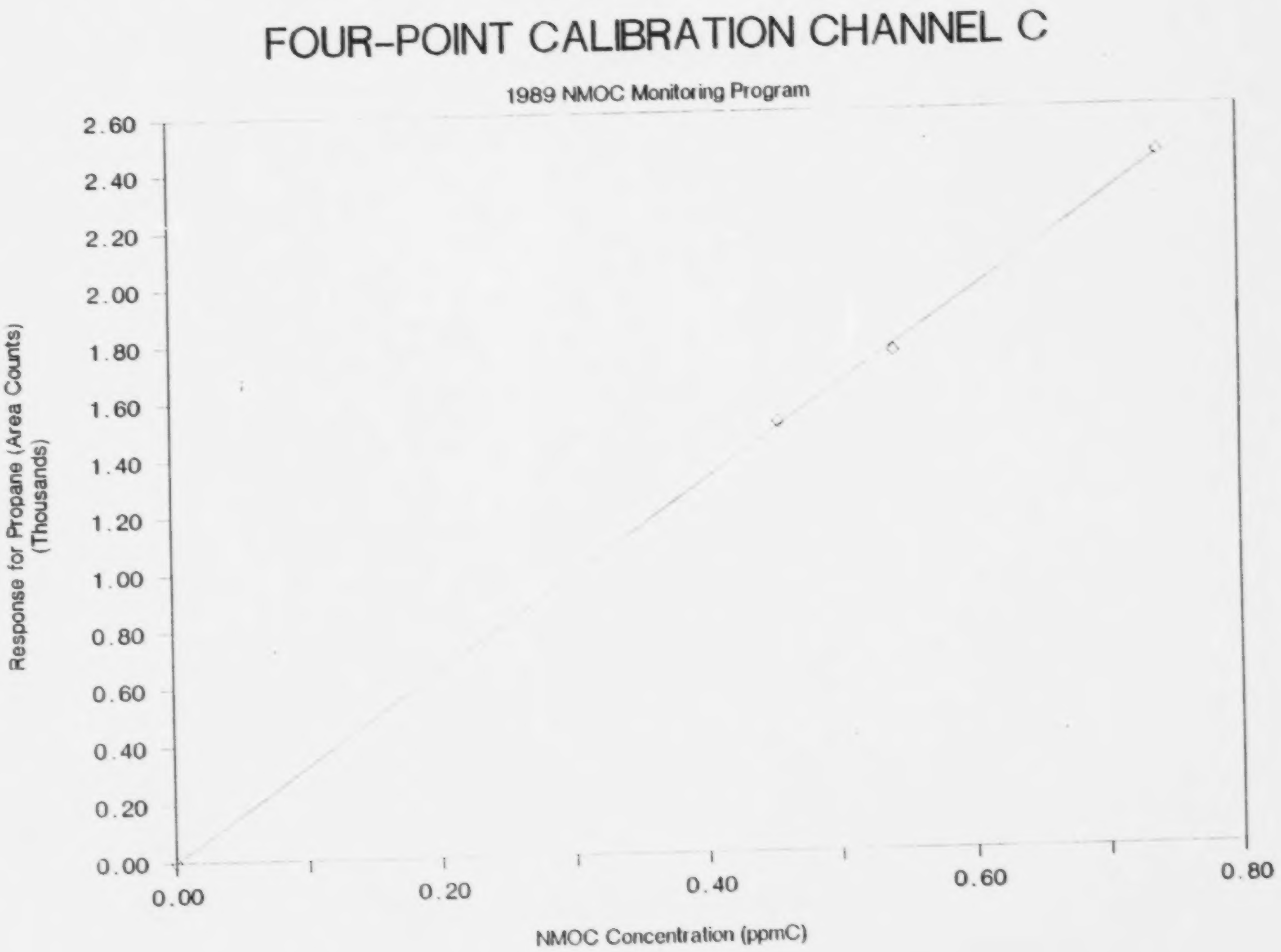


Figure 4-3. NMOC performance results, Channel C.

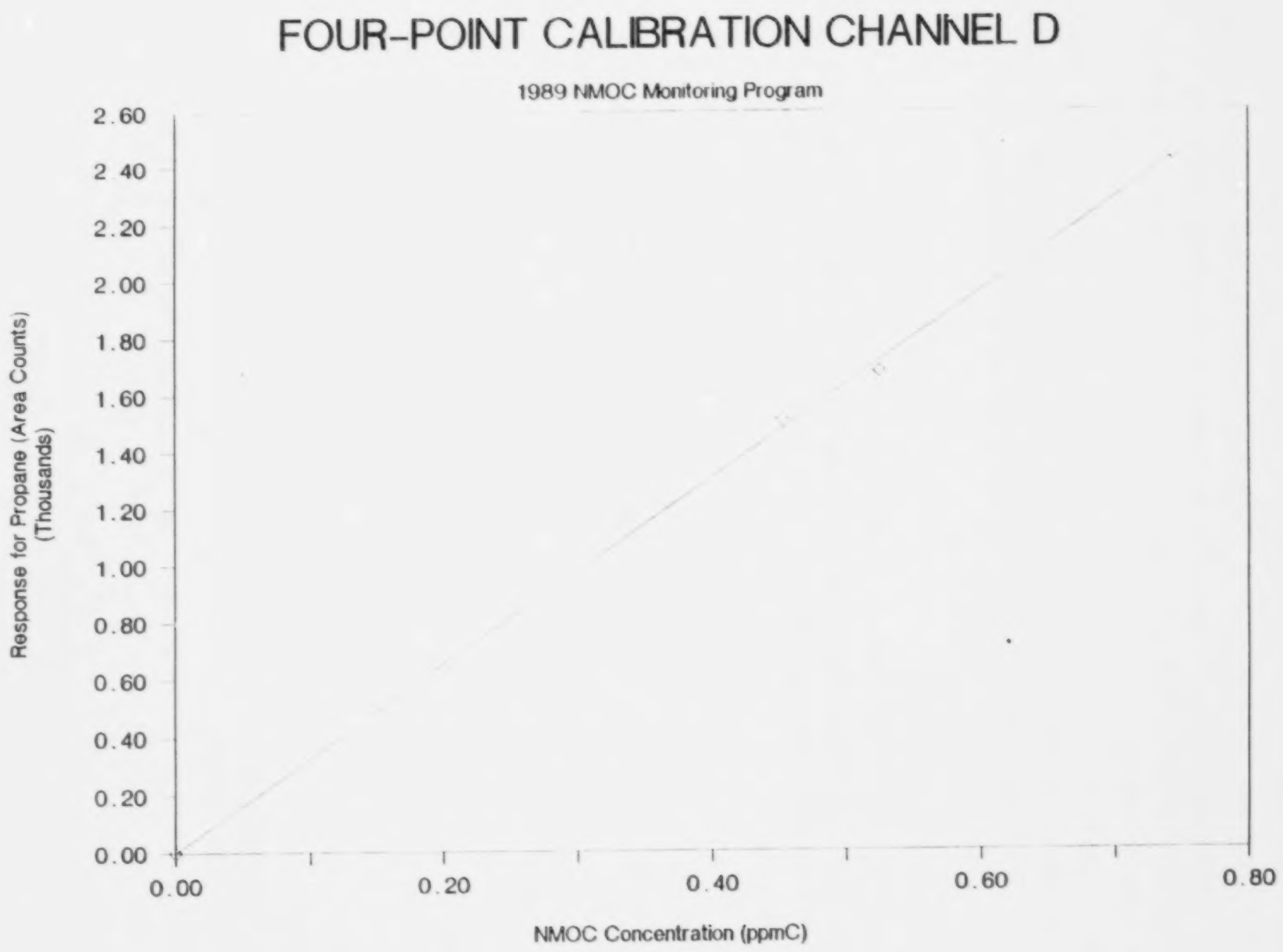


Figure 4-4. NMOC performance results, Channel D.

calibration factor drifts were determined based on the initial calibration factor. The data for zeros, calibration factors, and calibration factor drifts are given in Appendix F for each Radian channel and each calendar day of the analysis season. Figures 4-5 through 4-8 show plots for daily calibration zeros for Radian Channels A, B, C, and D. Figures 4-9 through 4-12 show the daily calibration span data as a function of the 1989 Julian date. Figures 4-13 through 4-16 show daily percent drift figures for the 1989 Julian dates. Inspection of the percent drift figures shows that the maximum percent drift was 4.54. The average absolute % drift ranged from 0.483 for Channel A to 0.673 for Channel D.

4.2.3 Calibration Drift

Summary calibration factor drift data are given in Table 4-2. The table presents calibration factor drift, percent calibration factor drift, and absolute percent calibration factor drift. Calibration factors were calculated from an analysis of a propane-air mixture whose concentration was known and was referenced by the EPA-QAD to an NIST SRM No. 1666B propane reference standard as follows:

$$\text{calibration factor} = \frac{\text{concentration of propane standard (ppm) x 3 ppmC/ppm}}{\text{(propane standard response (area counts) - zero response (area counts))}}$$

Daily calibration factors ranged from 0.000293 ppmC/area count to 0.000334 ppmC/area count, depending on the channel. Maxima, minima, and mean values are given in Table 4-2 for calibration factor drift and percent calibration factor drift. If drift and percent drift are random variables and normally distributed, the mean values would be expected to be zero. The means shown in Table 4-2 for the drift and percent drift are approximately zero, showing little bias overall, or for any channel. The overall mean values shown in Table 4-2 were weighted according to the number of calibration drift data for each channel. The last two columns of Table 4-2 show the means and standard deviations of the absolute percent calibration factor drifts. The fact that the standard deviations are the same order of magnitude as the means indicates that the mean calibration factor drifts are not significantly different from zero.

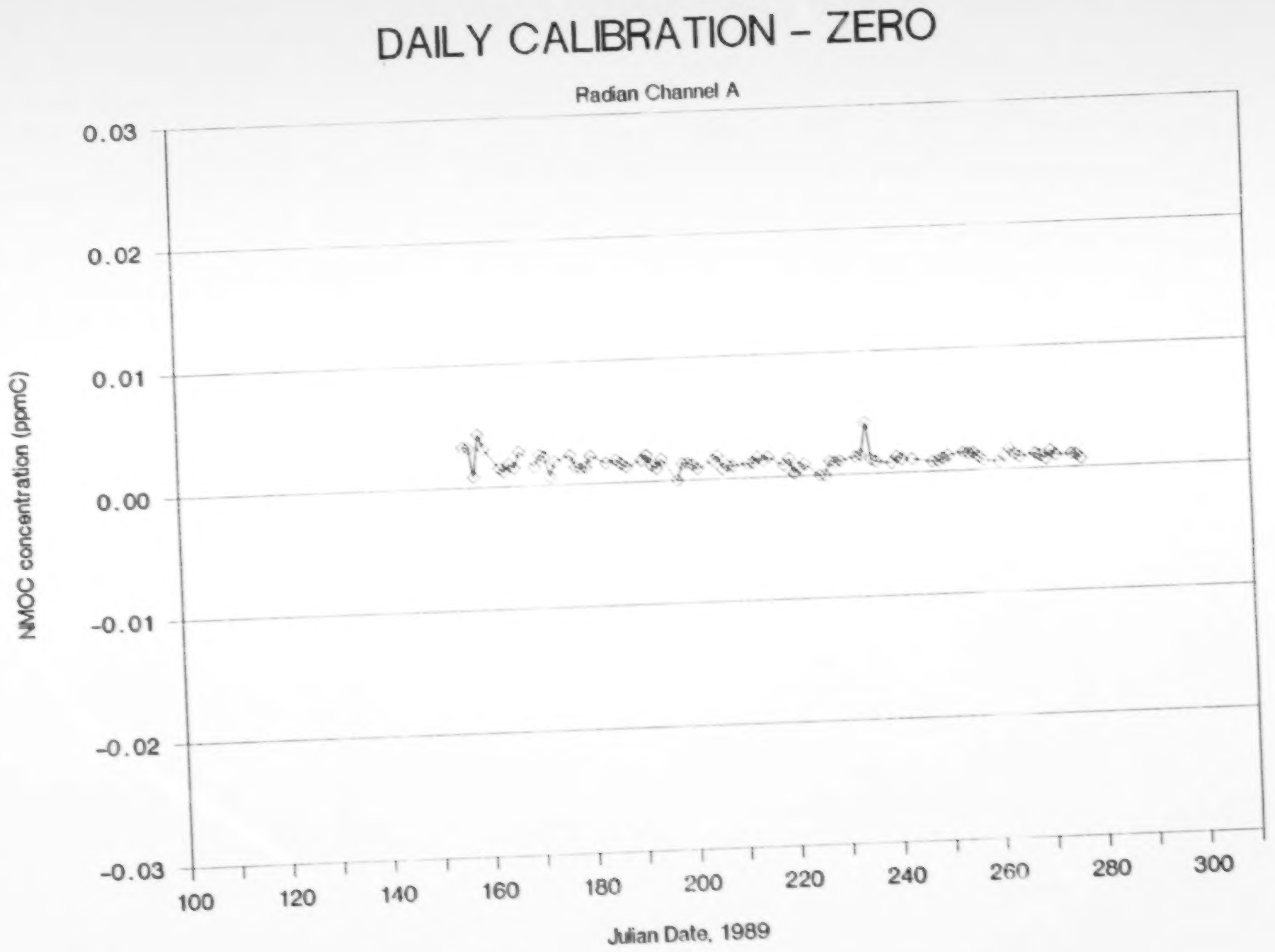


Figure 4-5. Daily calibration zero, Channel A.

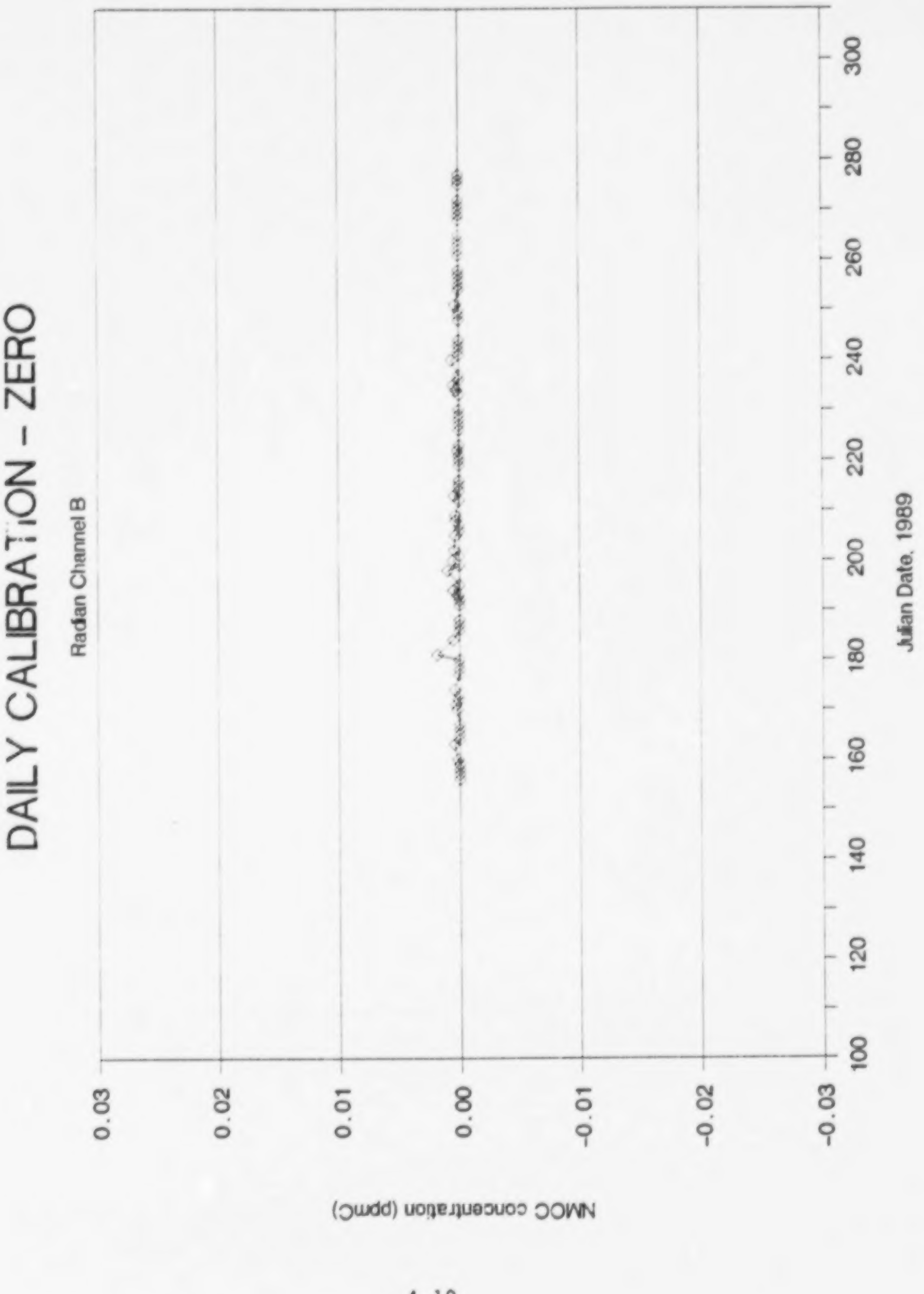


Figure 4-6. Daily calibration zero, Channel B.

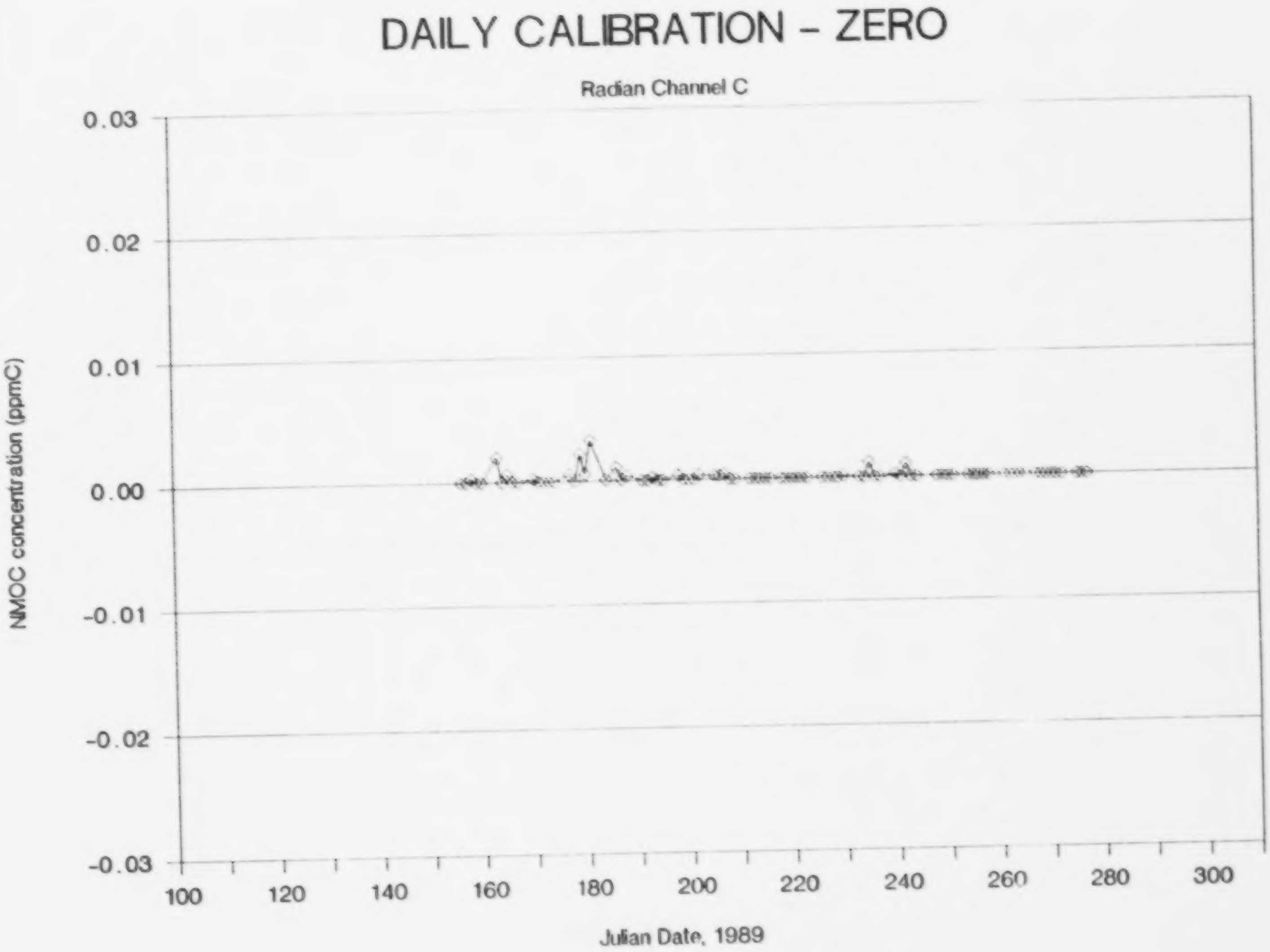


Figure 4-7. Daily calibration zero, Channel C.

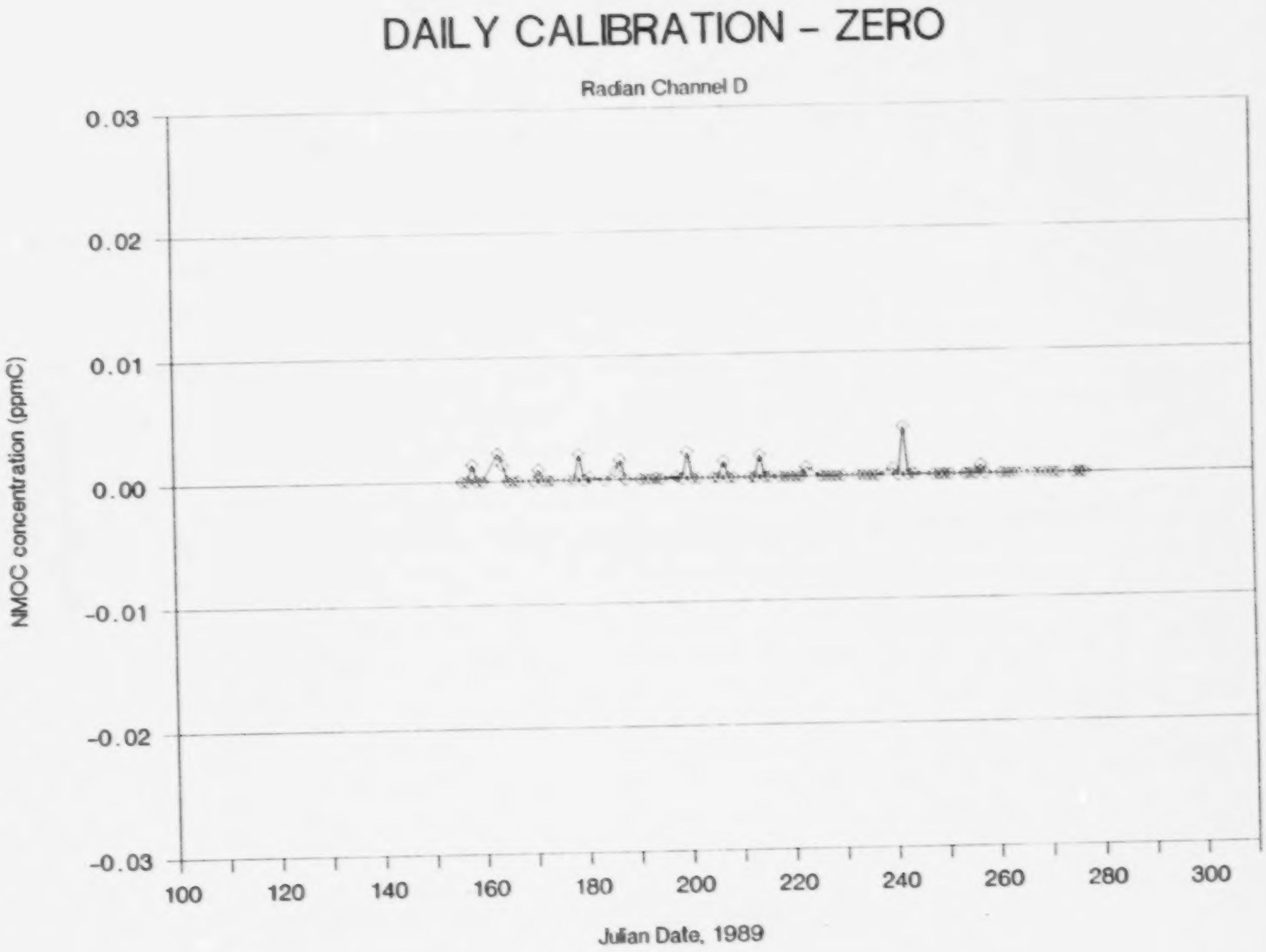


Figure 4-8. Daily calibration zero, Channel D.

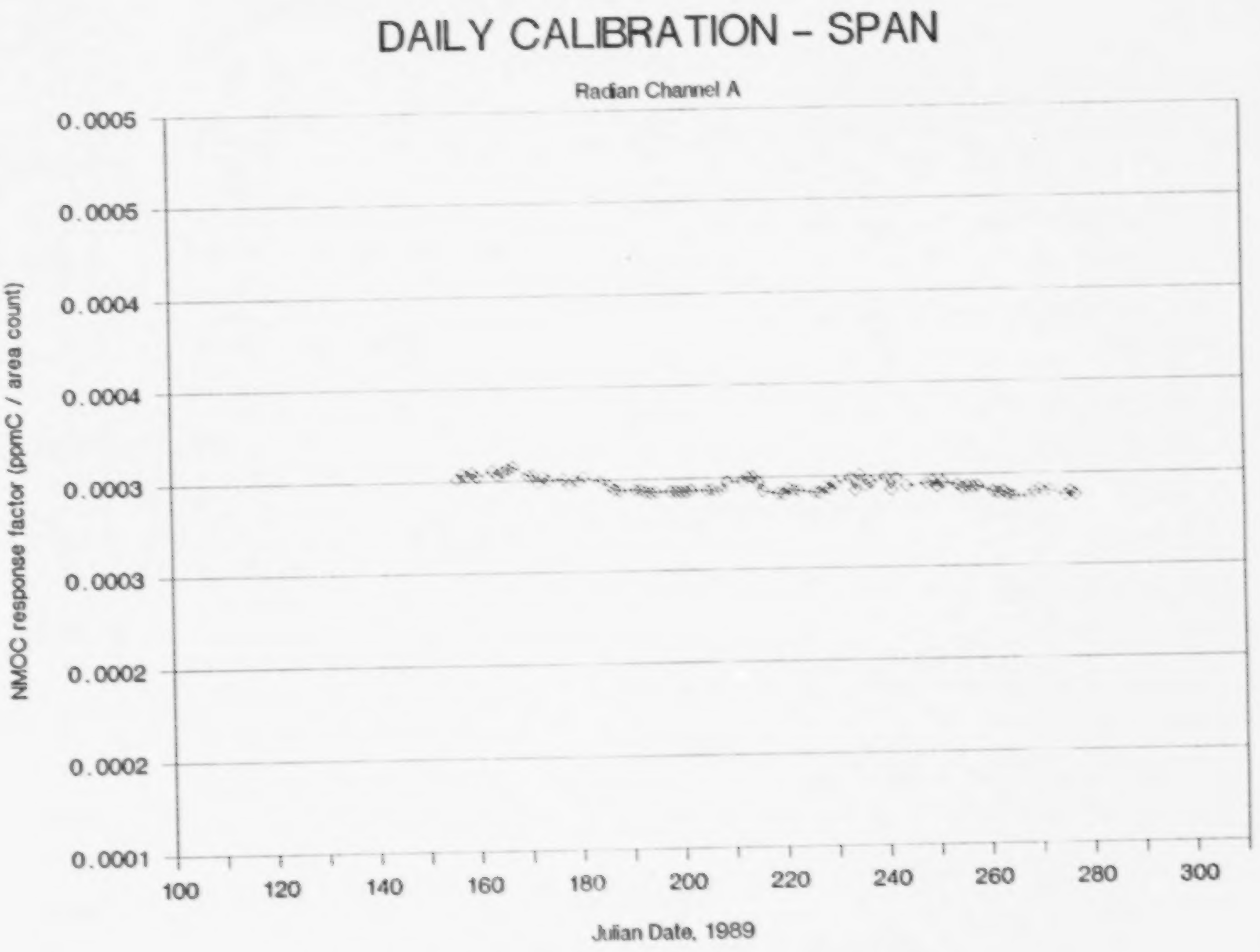


Figure 4-9. Daily calibration span, Channel A.

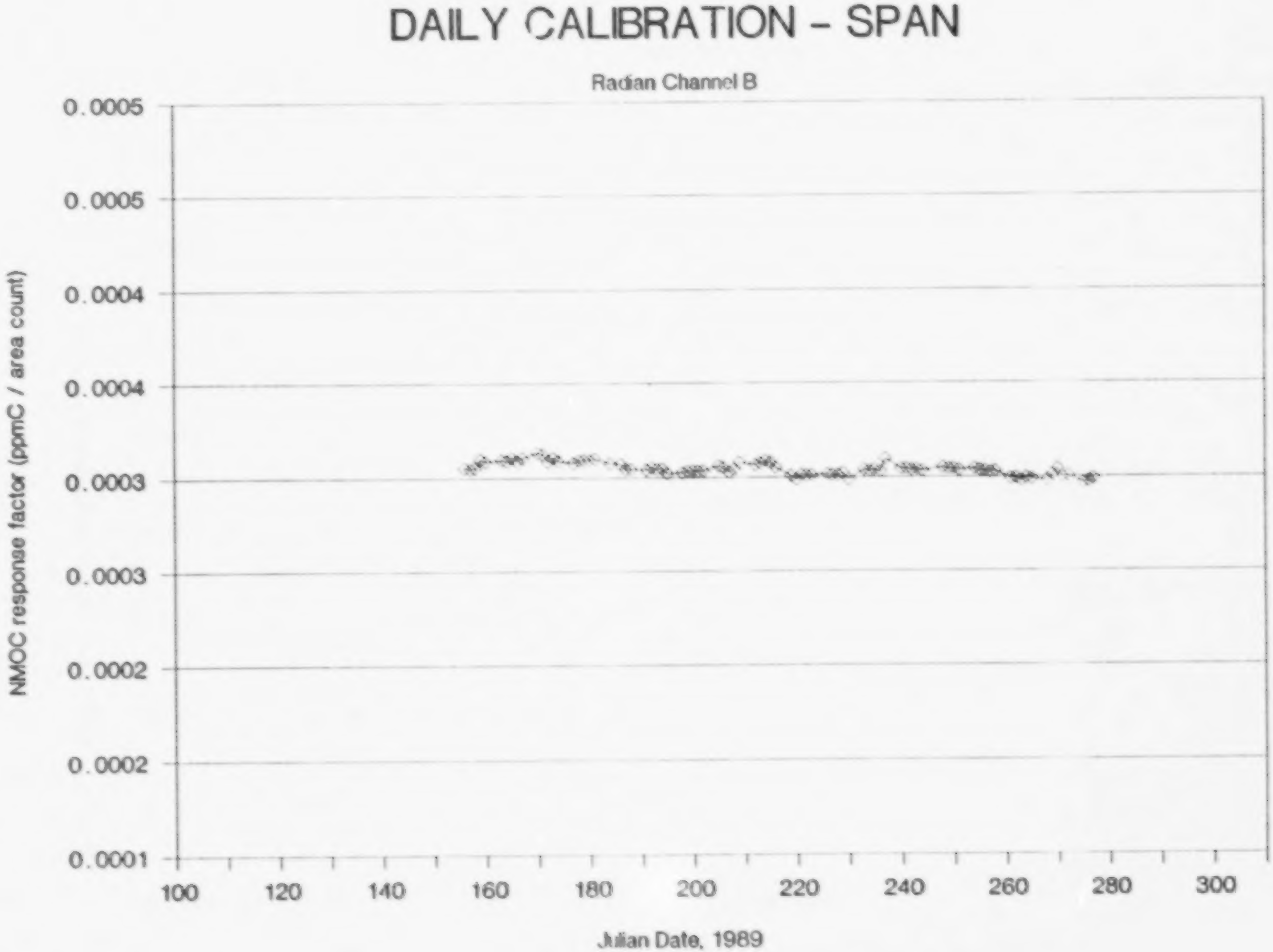


Figure 4-10. Daily calibration span, Channel B.

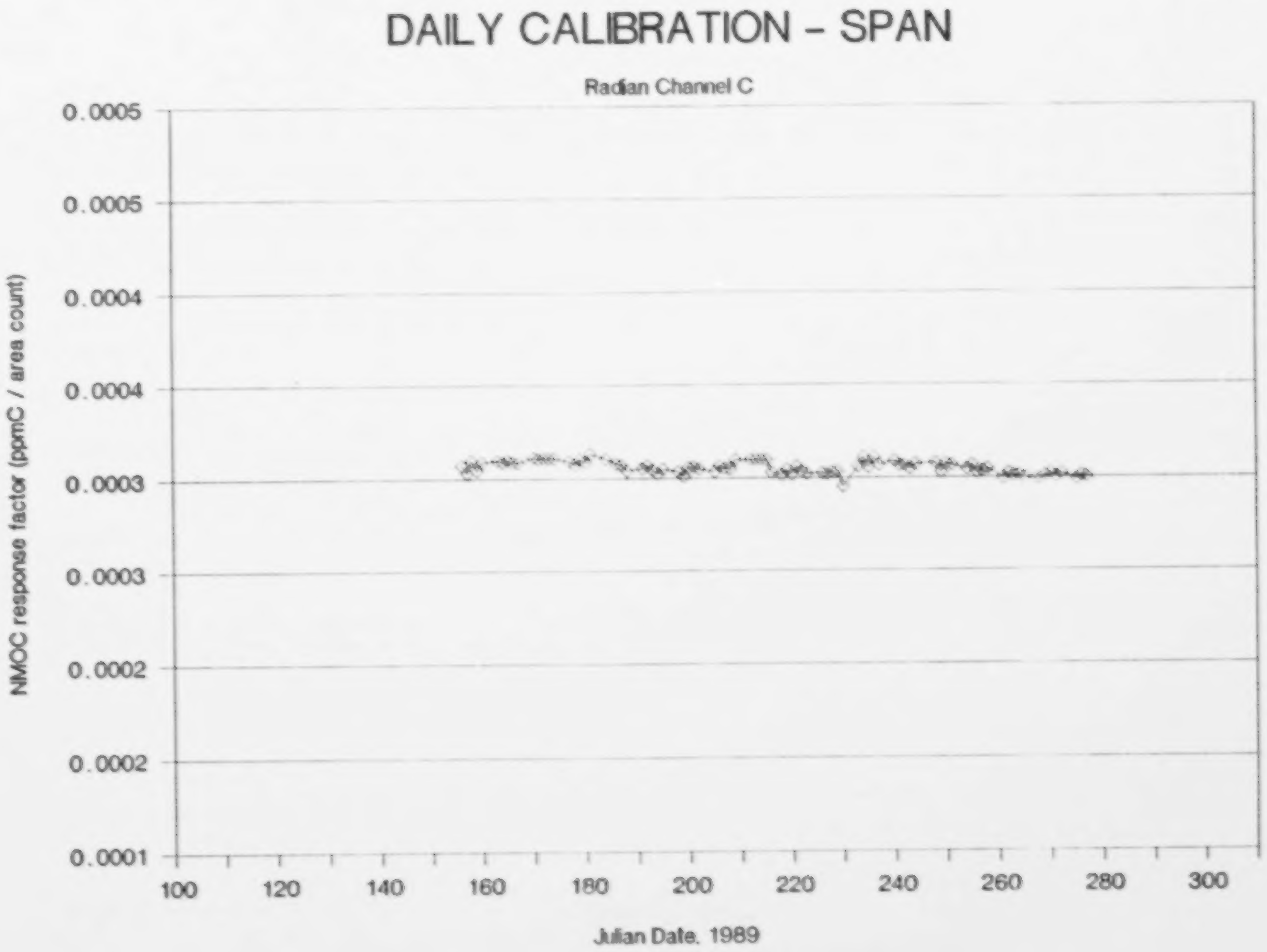


Figure 4-11. Daily calibration span, Channel C.

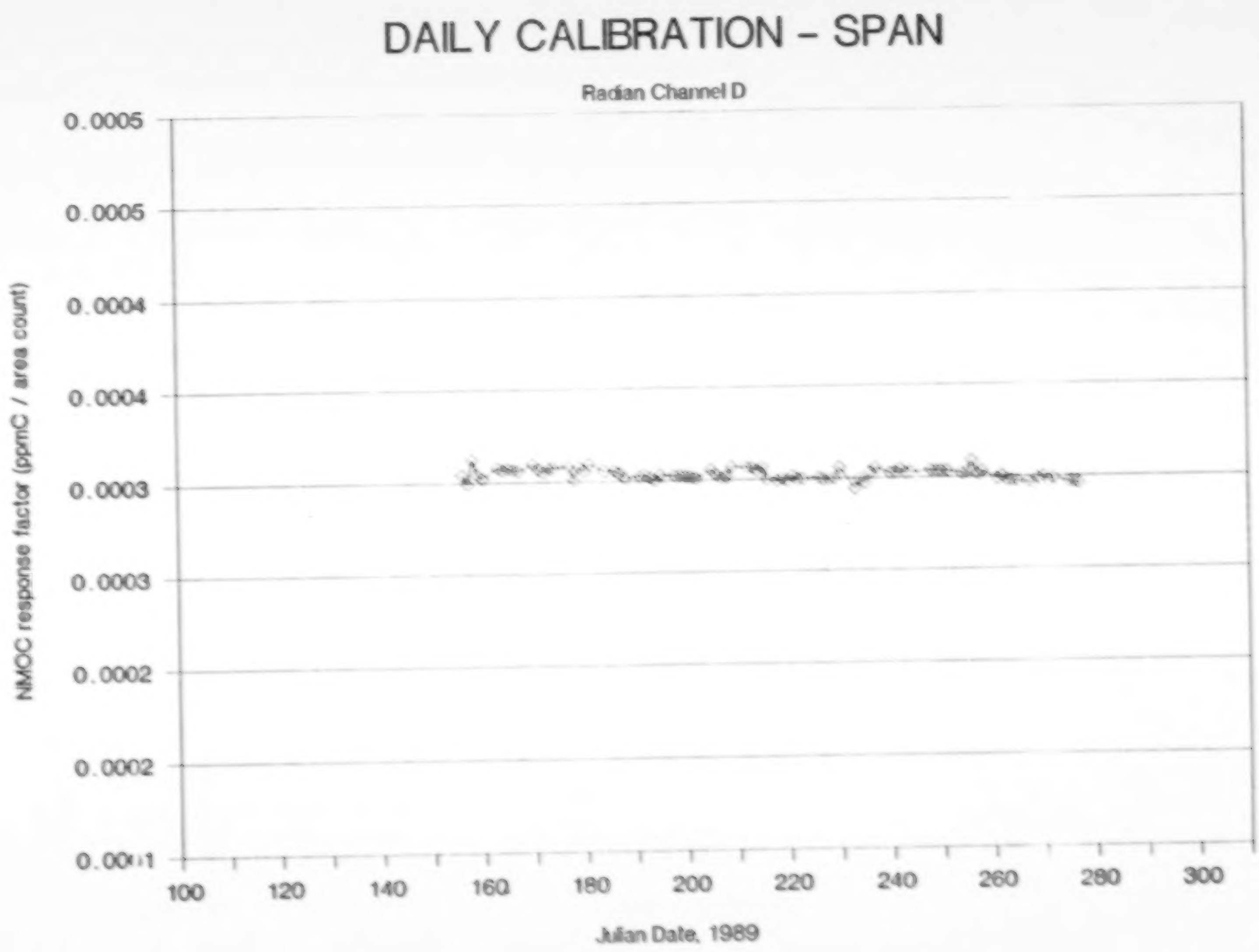


Figure 4-12. Daily calibration span, Channel D.

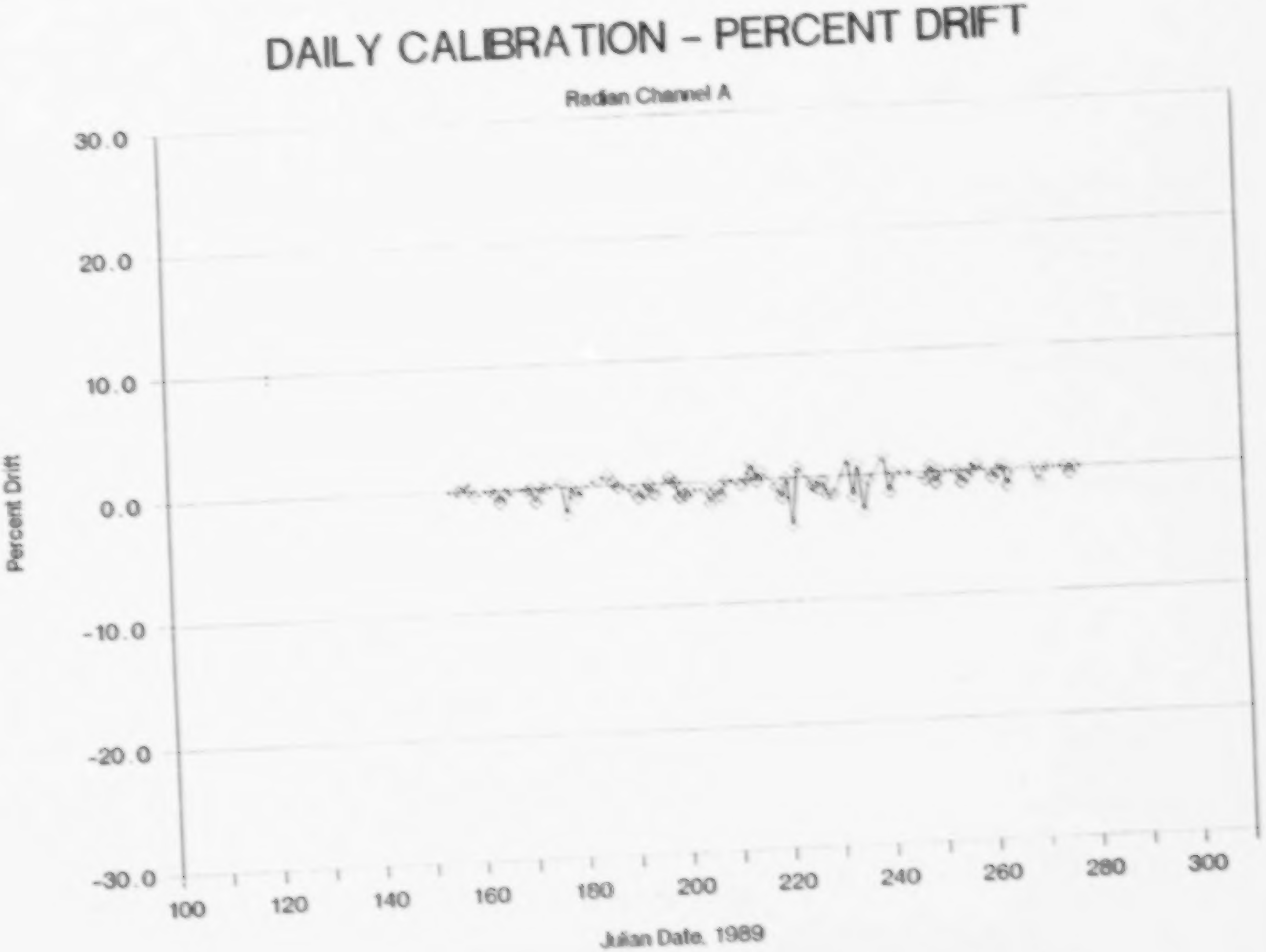


Figure 4-13. Daily calibration percent drift, Channel A.

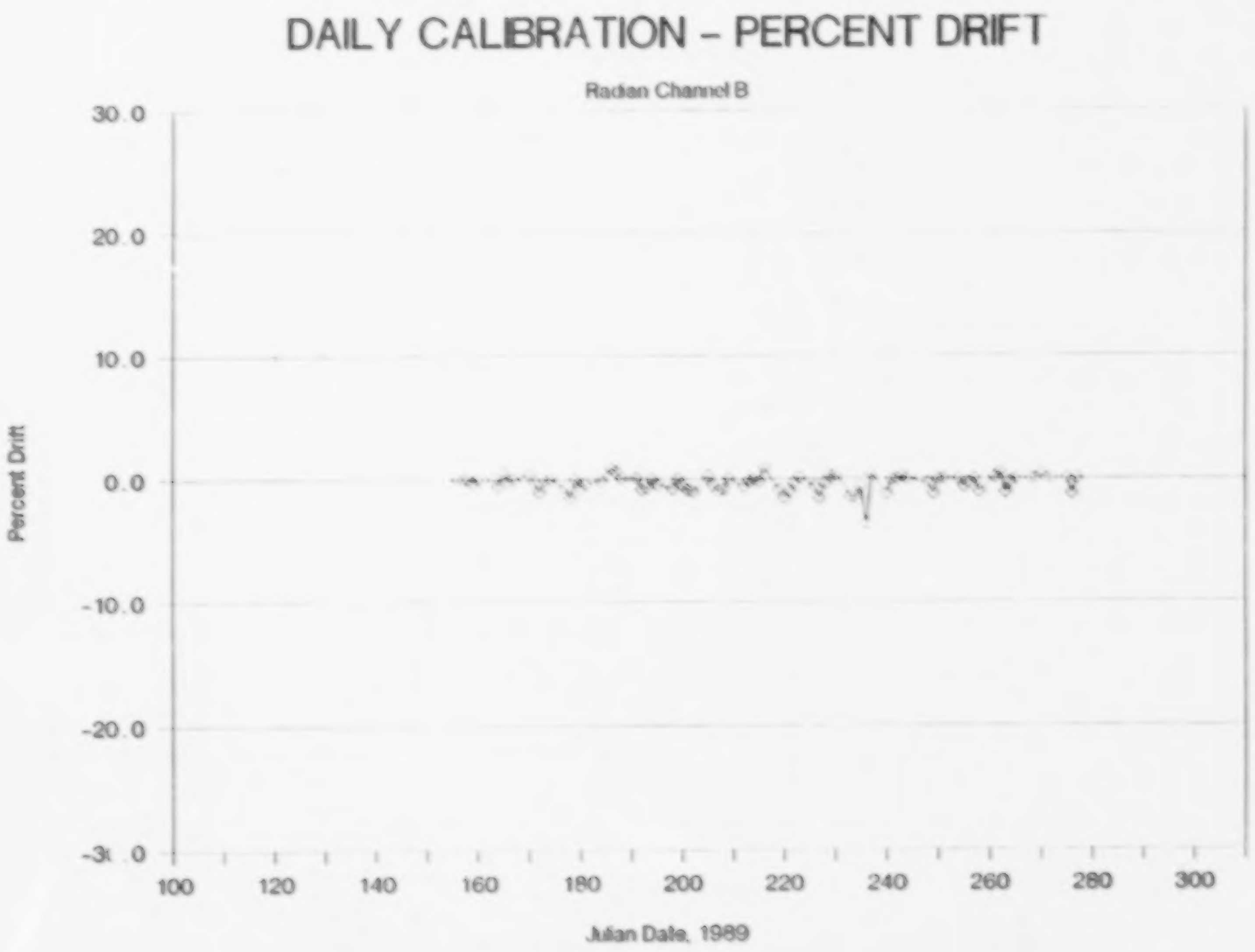


Figure 4-14. Daily calibration percent drift, Channel B.

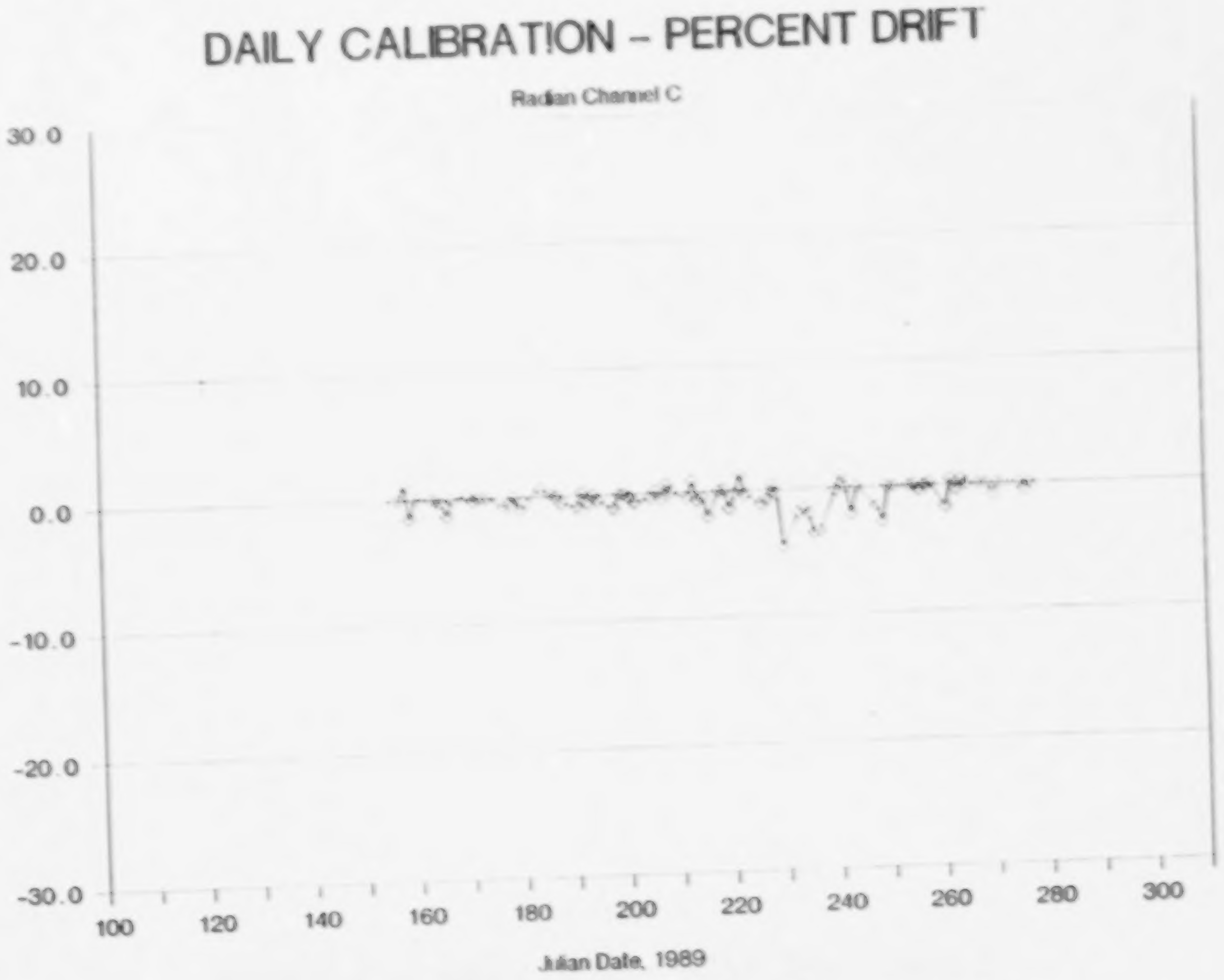


Figure 4-15. Daily calibration percent drift, Channel C.

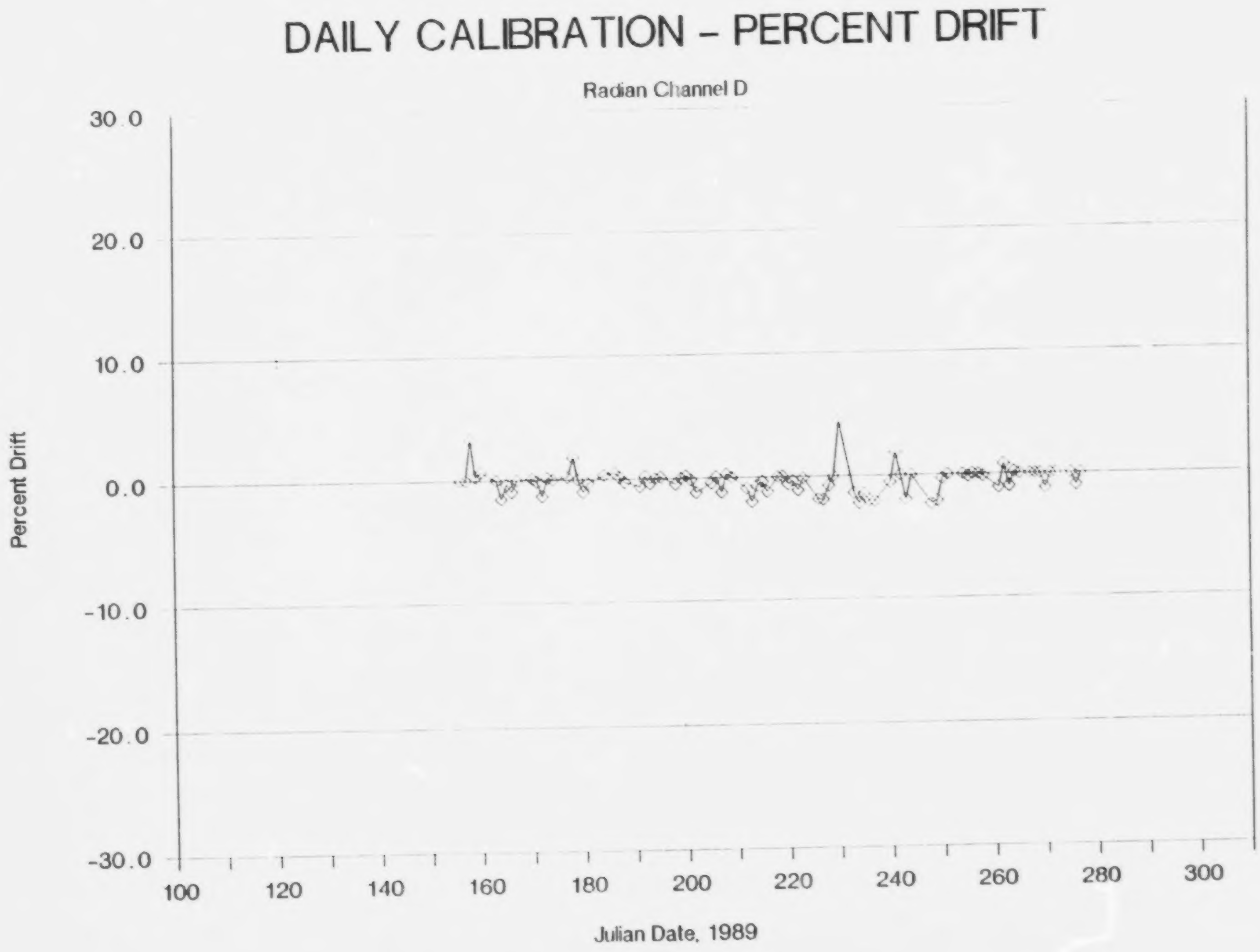


Figure 4-16. Daily calibration percent drift, Channel D.

TABLE 4-2. SUMMARY NMOC CALIBRATION FACTOR DRIFT RESULTS

Radian Channel	Cases	Calibration Factor Drift ppmC/Area Count x 10^{+6}			Percent Factor Drift			Absolute Percent Factor Drift	
		Min	Mean	Max	Min	Mean	Max	Mean	Standard Deviation
A	86	-12	-1	4	-3.9604	-0.3954	1.4164	0.6458	0.7021
B	86	-11	-1	3	-3.6005	-0.3484	0.9255	0.4836	0.5683
C	88	-13	-1	4	-4.5410	-0.4395	1.2395	0.6244	0.8575
D	88	-7	-1	14	-2.3572	-0.3167	4.4605	0.6725	0.8509
Overall	348	-13	-1	14	-4.5410	-0.3750	4.4605	0.6071	0.7764

Calibration factor drift was defined as final calibration factor for the day, minus initial calibration factor. Percent calibration factor drift was defined as the calibration factor drift divided by the initial calibration factor, expressed as a percentage. The absolute percent calibration factor drift is a measure of the calibration drift variability and averaged 0.607% overall. The mean absolute percent calibration drift ranged from 0.484% for Radian Channel B to 0.673% for Radian Channel D.

4.3 IN-HOUSE QC SAMPLES

In-house quality control samples were prepared daily except for one day during the week on which duplicate local ambient samples were collected for "round-robin" analyses. The local ambient samples were analyzed not only by all Radian PDFID channels, but by the EPA-QAD instrument. Local ambient sample results are presented and discussed in Section 4.4.4. In-house quality control samples were prepared by diluting dry propane with cleaned, dried air using calibrated flowmeters. The propane used for the in-house quality control samples was certified by the EPA-QAD against an NIST Reference Standard. The concentration of the in-house standard ranged from about 0.020 ppmC to 18.000 ppmC, but was set to average near the concentration levels that were being analyzed (0.100 to 3.000 ppmC). The analyst did not know the concentration of the in-house standard prior to analysis.

The daily in-house QC data for each Radian channel are given in Appendix G, and include:

- Calendar date analyzed;
- Julian date for 1989;
- Radian ID Number;
- Calculated NMOC concentration in ppmC;
- Measured NMOC concentration in ppmC;
- Bias (measured NMOC-calculated NMOC); and
- % Bias (Bias * 100 / calculated NMOC).

Measured versus calculated NMOC concentrations in Figures 4-17 through 4-20 show excellent agreement. Table 4-3 summarizes the results of the linear regressions for the Radian in-house quality control data, showing regression intercepts near zero, and slopes and coefficients of correlation all near 1.0.

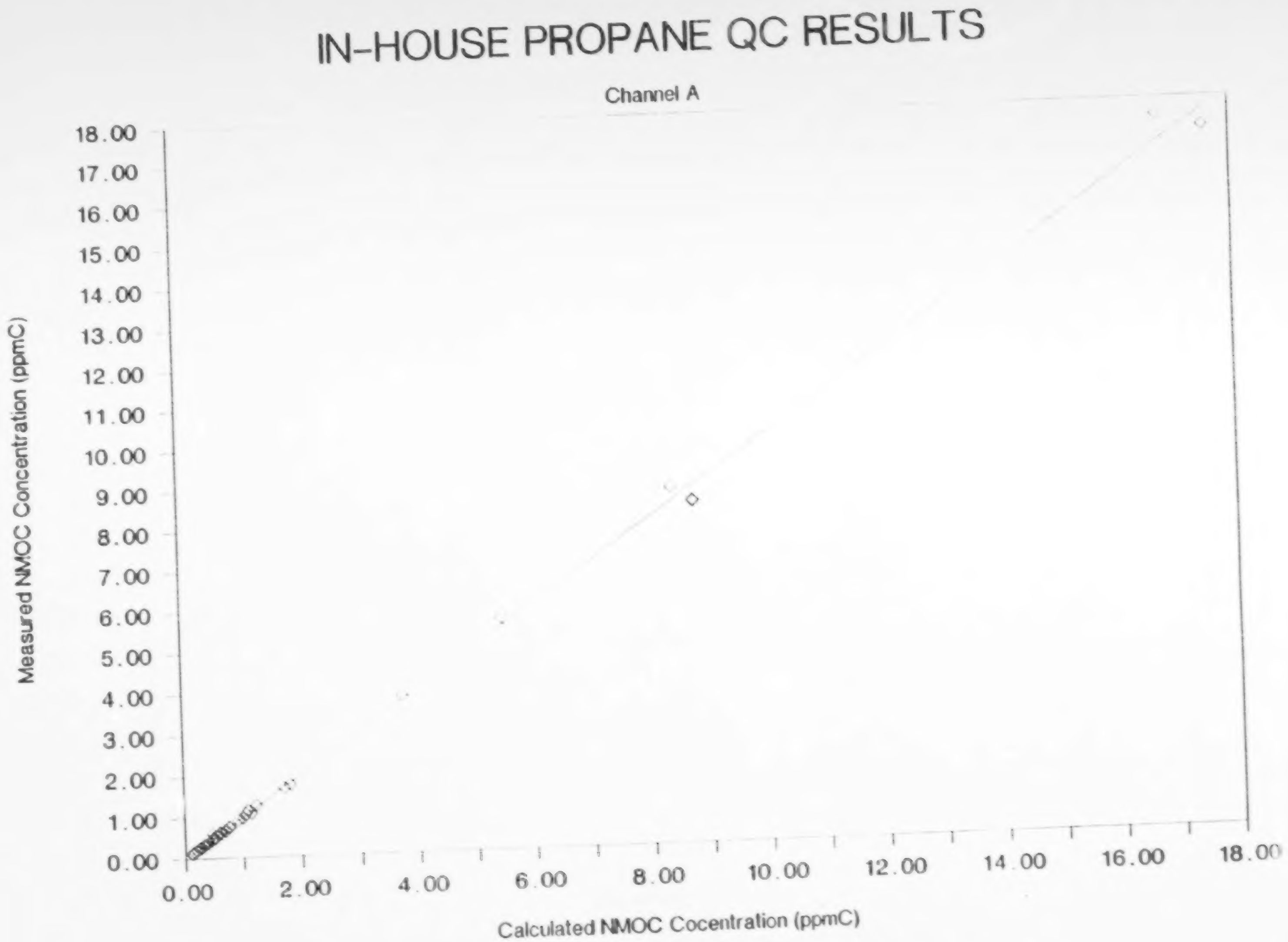


Figure 4-17. In-house quality control results, Channel A.

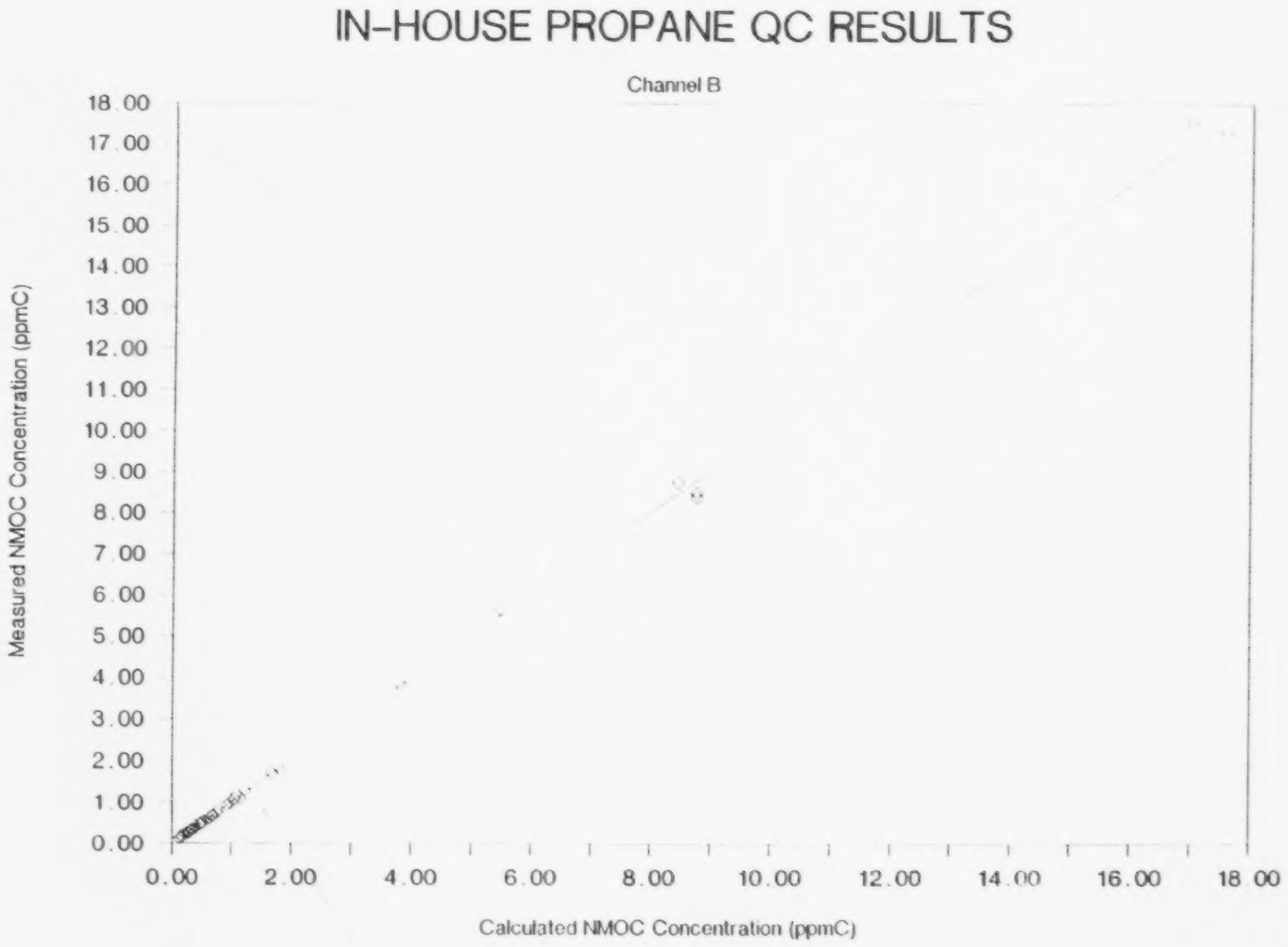


Figure 4-18. In-house quality control results, Channel B.

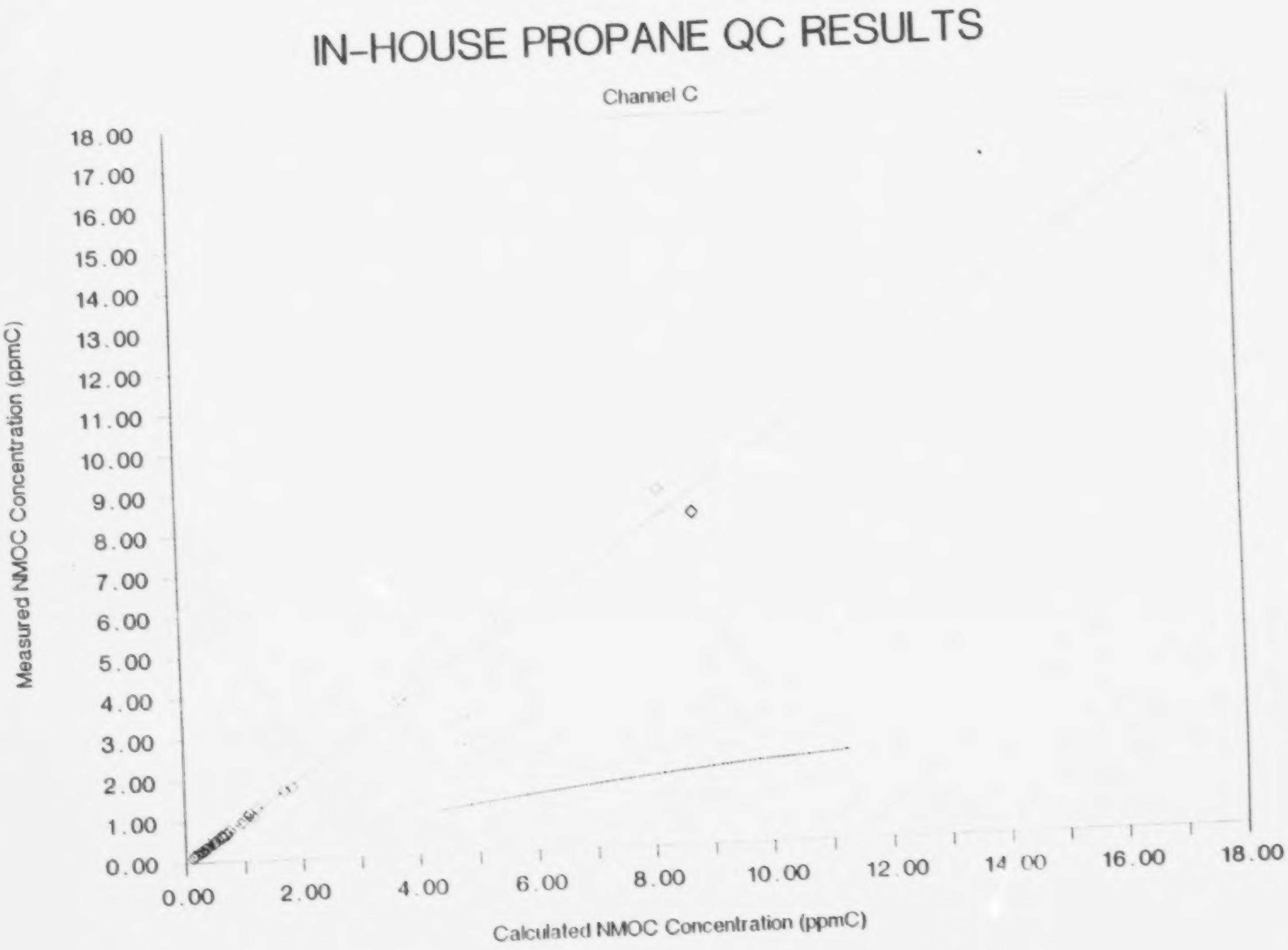


Figure 4-19. In-house quality control results, Channel C.

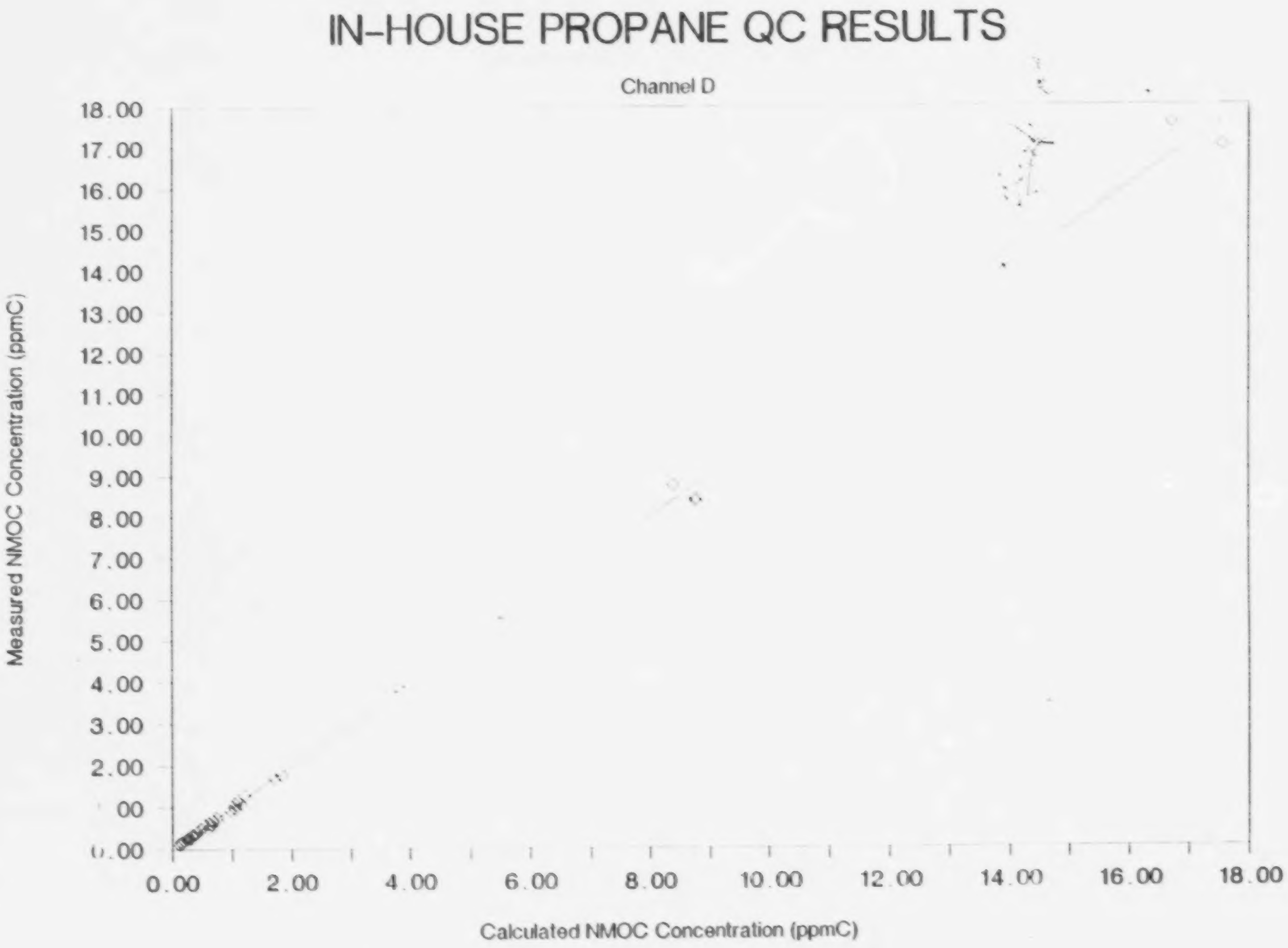


Figure 4-20. In-house quality control results, Channel D.

TABLE 4-3. LINEAR REGRESSION PARAMETERS FOR IN-HOUSE QUALITY CONTROL DATA

Radian Channel	Cases	Intercept	Slope	Coefficient of Correlation
A	51	-0.000182	1.007578	0.999184
B	51	0.005195	1.004650	0.999451
C	51	0.010023	0.997043	0.998786
D	51	0.001783	1.002389	0.998910

Tables 4-4 and 4-5 give statistics for in-house quality control measurements. DIFF is the ppmC difference between the measured and the calculated NMOC concentrations, and PCDIFF is the percentage of the difference relative to the calculated value. Both DIFF and PCDIFF may be considered to be bias terms, assuming that the calculated value is the correct NMOC concentration for the in-house QC sample. Overall, PCDIFF shows a mean bias of +1.27%, and ranges from -18.59% for Channel D to +31.45% for Channel B. ADIFF and APCDIFF, absolute values of DIFF and PCDIFF, respectively, were used as measures of precision. The absolute percent difference ranged from 4.69% for Channel B to 5.46% for Channel D and averaged 5.02 percent. These figures show excellent agreement and consistency for the in-house quality control data and include variability not only in the instrumental analysis but also in the apparatus and method used to generate the QC samples.

Figure 4-21 shows a stem-and-leaf plot of DIFF, the NMOC difference between the calculated and measured in-house quality control samples. The figure shows little skewness, and shows the differences to be approximately normally distributed, which supports the assertion that DIFF is a random variable. The normal distribution of DIFF also implies that there is no significant bias among instrument channels.

4.4 REPEATED ANALYSES

Two types of repeated analyses were conducted in this study. The first type of repeated analysis was conducted primarily to establish precision, and to determine if significant differences in precision existed among Radian (PDFID) channels, the EPA-QAD (PDFID) channel, and the EPA-AREAL (GC/FID) channel. Two samples were selected daily from the received site samples for a second analysis on a Radian channel on the following workday. The second replicate analysis was performed on the day after the first analysis to allow time for the ambient air sample in the canister to equilibrate between analyses. At the beginning of the first analysis, the pressure in the canister is typically about 15 psig. At the beginning of the second analysis, the canister pressure is typically 9 psig.

TABLE 4-4. IN-HOUSE QUALITY CONTROL STATISTICS, BY RADIAN CHANNEL

Channel	Statistics	Variables			
		DIFF[a]	ADIFF[b]	PCDIFF[c]	APCDIFF[d]
A	Cases	50	50	50	50
	Minimum	-0.366000	0.000000	-10.345000	0.000000
	Maximum	0.794000	0.794000	28.390000	28.389830
	Mean	0.014020	0.069708	1.024200	4.698099
	Std. Dev.	0.157111	0.141160	6.701800	4.843689
	Std. Error	0.022219	0.019963	0.947778	2.846198
	Skewness	2.131025	3.391473	1.641115	2.846198
	Kurtosis	11.872723	12.754924	4.359463	10.374671
B	Cases	50	50	50	50
	Minimum	-0.363000	0.000000	-11.077000	0.000000
	Maximum	0.582000	0.582000	31.453000	31.453360
	Mean	0.013920	0.061368	1.560380	4.919399
	Std. Dev.	0.127542	0.112348	7.485092	5.815267
	Std. Error	0.01037	0.015888	1.058552	0.822403
	Skewness	1.322336	2.897890	1.696878	2.664036
	Kurtosis	8.400402	8.709848	4.414086	7.989274
C	Cases	50	50	50	50
	Minimum	-0.624000	0.000000	-9.677000	0.000000
	Maximum	0.590000	0.624000	28.936000	28.936170
	Mean	0.004480	0.084248	1.320620	5.000242
	Std. Dev.	0.187379	0.166999	7.300220	5.436925
	Std. Error	0.026499	0.023617	1.032407	0.768897
	Skewness	-0.425886	2.450505	1.588367	2.604469
	Kurtosis	5.955438	4.513826	3.862143	8.131657
D	Cases	50	50	50	50
	Minimum	-0.566000	0.000000	-18.593000	0.000000
	Maximum	0.845000	0.845000	25.828000	25.827810
	Mean	0.006260	0.079188	1.207040	5.458642
	Std. Dev.	0.177757	0.158869	7.722464	5.542515
	Std. Error	0.025139	0.022467	1.092121	0.783830
	Skewness	1.321056	3.244163	0.841692	1.956190
	Kurtosis	10.808134	10.828937	2.023071	3.797688

[a] DIFF = Measured NMOC concentration - Calculated NMOC concentration, ppmC.

[b] ADIFF = Absolute value of DIFF.

[c] PCDIFF = DIFF/calculated NMOC concentration x 100.

[d] APCDIFF = Absolute value of PCDIFF.

TABLE 4-5. OVERALL IN-HOUSE QUALITY CONTROL STATISTICS

Statistics	DIFF[a]	ADIFF[b]	PCDIFF[c]	APCDIFF[d]
Cases	200	200	200	200
Minimum	-0.624000	0.000000	-18.593000	0.000000
Maximum	0.845000	0.845000	31.453000	31.453360
Mean	0.009670	0.073628	1.278060	5.019096
Std. Dev.	0.162874	0.145512	7.259442	5.387349
Std. Error	0.011517	0.010289	0.513320	0.380943
Skewness	0.864308	3.068350	1.417151	2.508747
Kurtosis	9.773681	9.571014	3.620947	7.379894

[a] DIFF = Measured NMOC concentration - Calculated NMOC concentration, ppmC.

[b] ADIFF = Absolute value of DIFF.

[c] PCDIFF = DIFF/calculated NMOC concentration x 100.

[d] APCDIFF = Absolute value of PCDIFF.

```
-56        6666
-38        9999
-33        6666
-11        1
 -6        2
 -5        8543
 -4        99320
 -3        98776 411
 -2        99765 44442
 -1  H     99999 88644 32221 11100
 -0  M     99999 99999 88887 77665 44444 33333 32211 111
  0        00000 01112 22234 5689
  1        00001 22222 33333 35555 799
  2  H     01124 44456 899
  3        06999 999
  4        03788 839
  5        027
  6        7
  7        17
  8        11114
  8        5
  9        8
 10        3
 13        46
 14        56
 19        2
 22        34
 25        2
 31        8
 37        2
 38        3
 56        4
 58        2
 59        0
 79        4
 84        5
```

	DIFF. ppmC
Cases	200
Minimum	-0.566
Maximum	0.845
Mean	0.007
Standard Deviation	0.167
Standard Error	0.012
Skewness	0.708
Kurtosis	9.041
Lower Hinge (H)	-0.014
Median (M)	0.000
Upper Hinge (H)	0.026

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Figure 4-21. Stem-and-leaf plot of in-house quality control differences.

The QAPP[2] specified which Radian channels were selected for the repeated analyses, so that all combinations of channel pairs, i.e., A-A, B-B, B-C, A-D, etc., would be selected randomly. The EPA-QAD and the EPA-AREAL channels randomly repeated analyses of the site samples already analyzed once by Radian. Shortly after the beginning of the 1988 NMOC Monitoring Program, the decision was made by Radian and the EPA to do repeated analyses only on duplicate samples, and to have the second analysis, not only on the day after the first analysis, but also on the same Radian channel as the first analysis. The purpose of the latter specification on replicate analyses was to avoid any bias that may be caused by a different analysis channel. None of the site samples selected for repeated analyses by Radian channels was analyzed a third time by an EPA channel.

All replicate analyses were performed on duplicate samples, but not all the analyses on duplicate samples were replicated. Each analysis consisted of two or three consecutive injections from a canister that was connected to the GC. After the first analysis, the canister valve was closed, the canister was disconnected from the GC, and the canister was stored at laboratory temperature overnight. The second replicate analysis on the sample in the canister was performed on the next day, or the following Monday if the first analysis was on Friday. Replicate analyses were performed on the same analytical channel, i.e., Radian Channel A, B, C, or D, for a given duplicate sample. By conducting repeated analyses of the duplicate samples it was possible to investigate the relative magnitude of the duplicate sampling precision and the analytical precision. The results for this investigation are given in Section 4.5.3.

The second type of comparative analysis was done on local ambient samples collected by EPA-QAD personnel in Raleigh, in Research Triangle Park, or near Research Triangle Park, North Carolina. These samples were taken once weekly in duplicate at an initial pressure of about 35 psig. Each local ambient sample, called a round-robin sample, was analyzed by all four Radian channels and the EPA-QAD channel. One of the duplicate round-robin samples was analyzed first in the Radian laboratory while the other duplicate round-robin sample was analyzed first in the EPA laboratories. Upon completion of the analyses, the laboratories exchanged canisters and analyzed the other duplicate sample on all channels. The purposes of these studies were:

- to determine if the order of analysis by one laboratory or channel made a significant difference in the measured NMOC value;
- to compare the precision of all the channels;
- to compare the PDFID method of analysis with the GC/FID speciated method of analysis; and
- to compare the results among Radian channels.

4.4.1 Site Sample Results

Figure 4-22 compares the EPA-QAD analyses with Radian analyses of the same site samples. Figure 4-23 compares the EPA-AREAL analyses with Radian analyses. Figure 4-24 compares AREAL analyses with QAD analyses. Orthogonal regression parameters for the three data sets are summarized in Table 4-6.

Summary statistics of the comparative analyses for Radian channels versus the EPA-QAD channel are given in Table 4-7. The table gives DIFF, the difference between the Radian NMOC concentration and the QAD NMOC concentration in ppmC; and PDIFF, the percent difference relative to the mean of the Radian and QAD analyses. ADIFF and APDIFF are the absolute values of DIFF and PDIFF, respectively. The mean percent difference shows Radian NMOC concentrations to average 11.11% higher than the QAD NMOC concentration. This is an average bias figure for the Radian analyses relative to a mean NMOC concentration. The average absolute percent difference is 13.92, which is a measure of the precision.

In 1985, the mean percent difference showed Radian NMOC concentrations to average 0.49% higher than QAD, and 3.77 lower in 1986. In 1987, the mean percent differences showed Radian concentrations to average 4.48% lower than the QAD NMOC concentration. In 1988, the difference was shown to be 1.674 percent. The average absolute percent difference was 10.5% in 1985, 14.8% in 1986, 14.07% in 1987 and 11.76% in 1988. The agreement among the precision results is good, and shows that the instruments and operating procedures were consistent for those years.

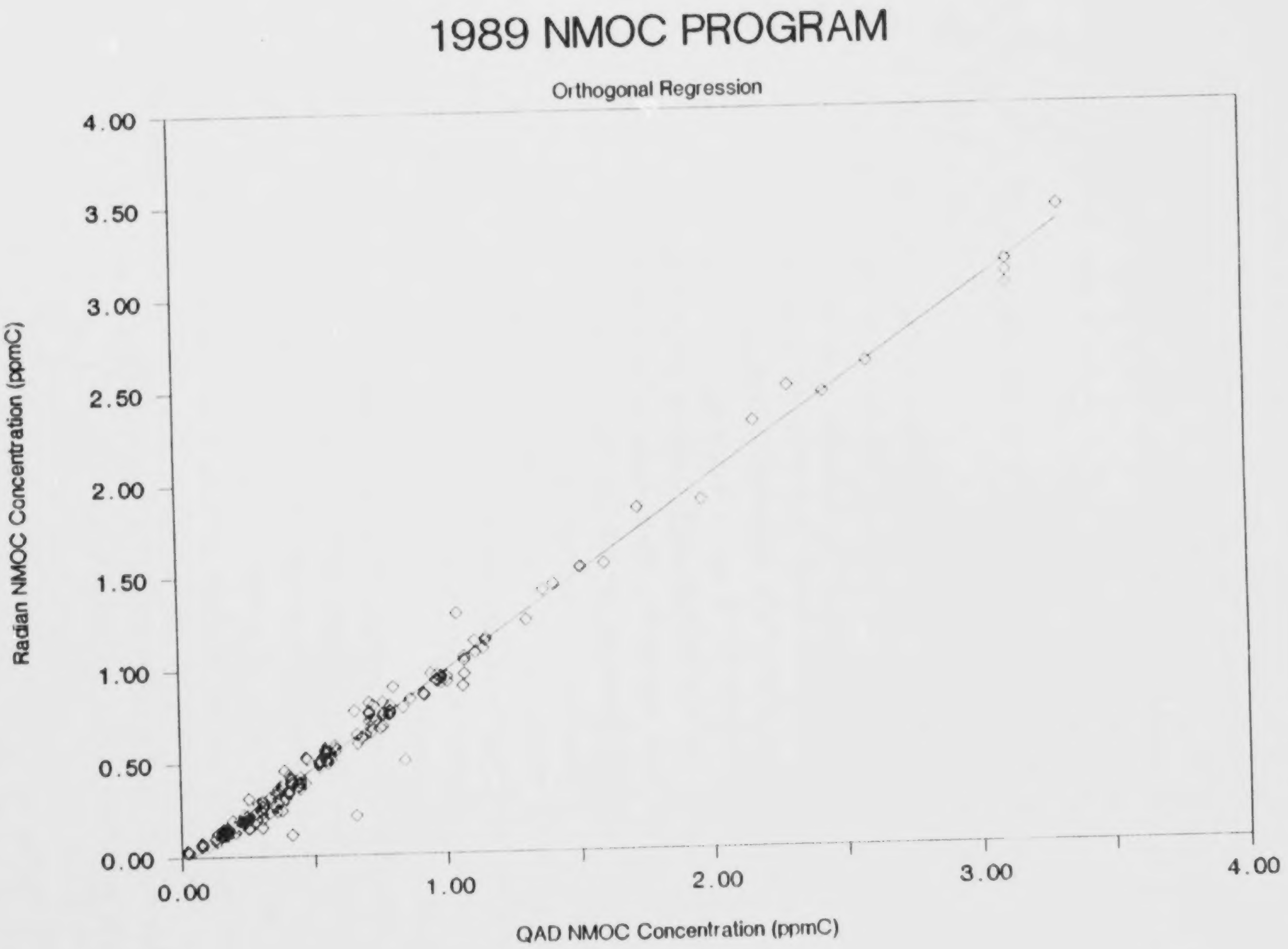

Figure 4–22. Orthogonal regression comparing QAD with Radian NMOC analyses.

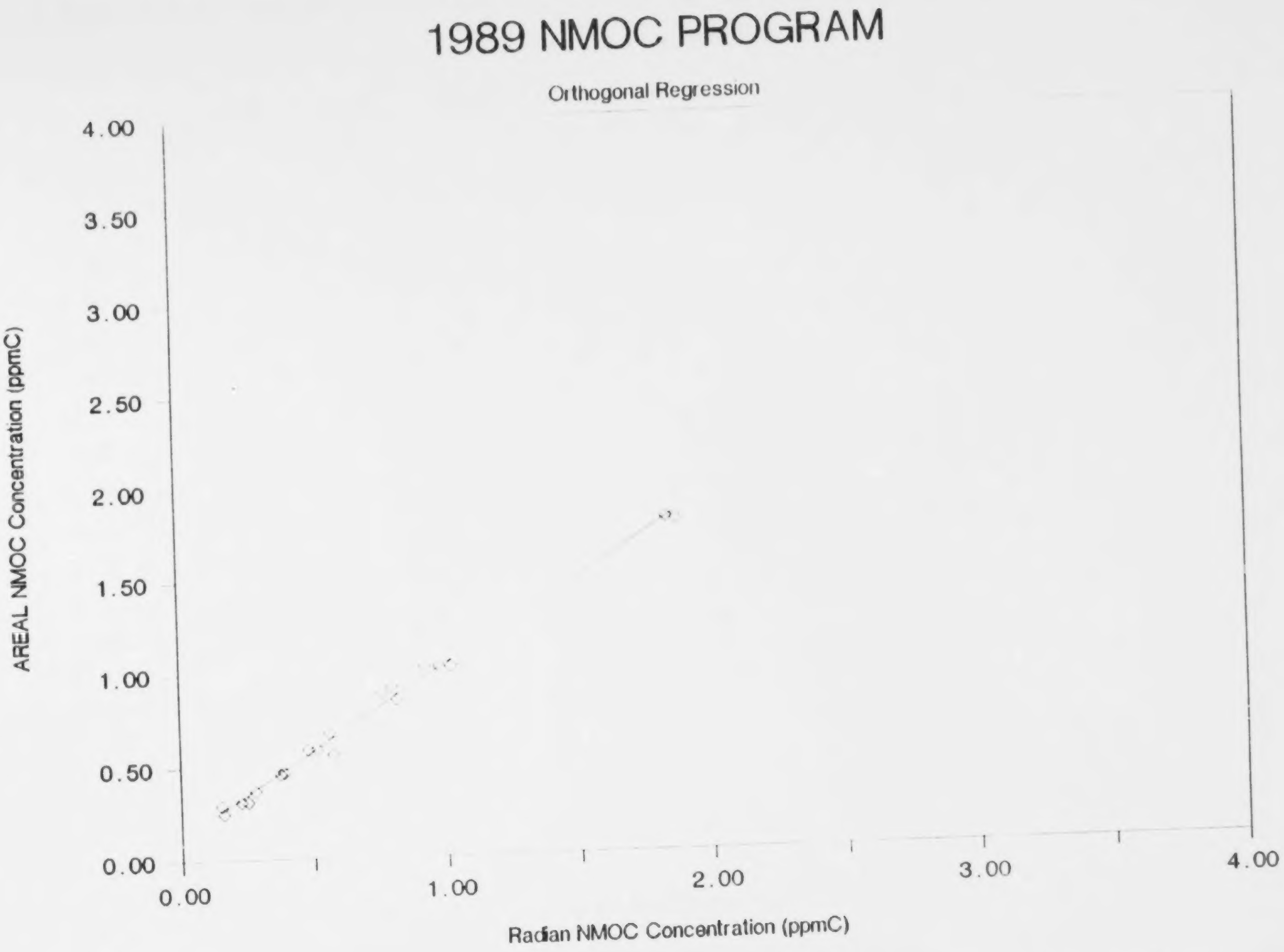

Figure 4-23. Orthogonal regression comparing AREAL with Radian analyses.

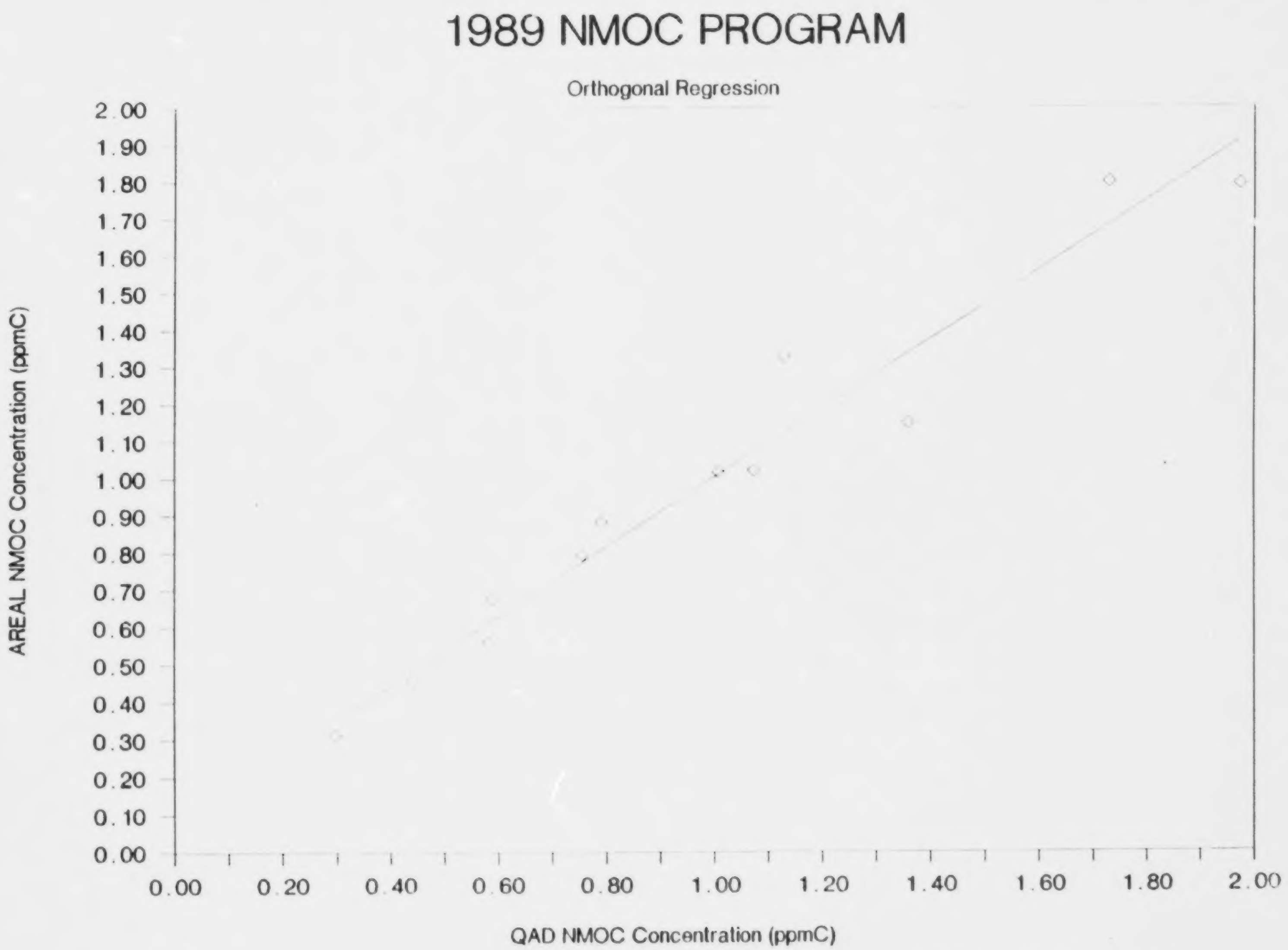

Figure 4-24. Orthogonal regression comparing QAD with AREAL NMOC analyses.

TABLE 4-6. ORTHOGONAL REGRESSION PARAMETERS FOR REPEATED ANALYSES OF SITE SAMPLES

Channel Pair (X-Y)	Cases	Intercept	Slope	Coefficient of Correlation
QAD-Radian	265	-0.041230	1.025452	0.995083
Radian-QAD	265	0.040208	0.975179	0.995083
ASRL-Radian	20	-0.136310	1.098092	0.995908
Radian-ASRL	20	0.124140	0.910670	0.995908
QAD-ASRL	12	0.069707	0.933637	0.9075807
ASRL-QAD	12	-0.074660	1.091079	0.975807

TABLE 4-7. SUMMARY STATISTICS OF COMPARITIVE ANALYSES FOR RADIAN vs. QAD CHANNELS

Statistics	Variables			
	DIFF	ADIFF	PDIFF	APDIFF
Cases	265	265	265	265
Minimum	-0.44600	0.00000	-113.20750	0.00000
Maximum	0.24200	0.44600	48.27590	113.20750
Mean	-0.02736	0.04281	-11.11275	13.92022
Standard Dev.	0.05834	0.04812	16.83605	14.59133
Standard Error	0.00358	0.00296	1.03423	0.89634
Skewness	-1.79171	4.25502	-1.54763	2.65780
Kurtosis	15.79171	26.35624	7.94459	12.16767

DIFF = Radian NMOC concentration - QAD NMOC cocentration, ppmC.
ADIFF = Absolute value of DIFF.
PDIFF = DIFF/((Radian NMOC conc. + QAD NMOC conc.)/2) x 100.
APDIFF = Absolute value of PDIFF.

Summary statistics are given for the same data in Table 4-8 by Radian channel. The data show a mean absolute percent difference ranging from 10.12% for Channel A to 20.29% for Channel B. The mean percent differences range from -18.05% for Channel B to -6.16% for Channel C.

Table 4-9 summarizes statistics for comparative analyses for Radian channels versus AREAL channels. DIFF is the difference between the NMOC values determined by Radian channels and the NMOC values determined by AREAL.

PDIFF averages 12.17%, although DIFF appears to be symmetrical about zero. APDIFF is 0.07%, which is lower than the APDELTA mean of 16.76% for 1988 and 15.88% for 1987. Table 4-10 compares Radian NMOC analyses with AREAL NMOC analyses, by Radian channels. APCDIFF values are 0.08%, 0.07%, 0.06%, and 0.07% comparing the AREAL channel with Radian Channels A, B, C, and D, respectively. PCDIFF averages are 19.06%, 11.46%, 8.17%, and 11.60% for AREAL versus Radian Channels A, B, C, and D, respectively.

Table 4-11 compares repeated analyses of site samples by the EPA-AREAL GC/FID instrument and the EPA-QAD PDFID instrument. The results show that PDELTA averaged 1.97%, while APDIFF averaged 7.85 percent. The table shows that the AREAL concentrations average 1.97% lower than the QAD concentrations. Radian concentrations were 11.11% higher than QAD concentrations. APDIFF between AREAL and QAD concentrations averaged 7.85%, whereas APDIFF for Radian and QAD concentrations averaged 13.92 percent.

Of NMOC concentration measurements, the comparison between Radian and the EPA-QAD channel represents between-laboratory comparisons for the PDFID method. Comparisons between the Radian channels and the EPA-AREAL channel are between-laboratory and between-method comparisons.

Table 4-12 summarizes statistics for repeated analyses on Radian channels. The QAPP[2] specified the channel pair to be involved with the repeated analysis each day. The mean APDIFF was the average percent difference between the second and the first analysis and was 8.24% for the overall data set. Table 4-13 shows the statistics for repeated analyses by Radian channel pairs. Table 4-14 gives the 95% confidence intervals for the mean differences by channel pairs. Figure 4-25 plots the means and 95% confidence intervals listed in Table 4-14. The circles on Figure 4-25 locate the mean difference for each channel pair. The vertical lines span the 95% confidence intervals of the mean differences.

TABLE 4-8. SUMMARY STATISTICS OF COMPARITIVE ANALYSES FOR RADIAN vs. QAD CHANNELS, BY RADIAN CHANNELS

		Variables			
Channel	Statistics	DIFF	ADIFF	PCDIFF	APCDIFF
A	Cases	60	60	60	60
	Minimum	-0.10100	0.00000	-43.98340	0.00000
	Maximum	0.04200	0.10100	33.96230	43.98340
	Mean	-0.02549	0.03033	-8.21561	10.11860
	Std. Dev.	0.02940	0.02429	12.37010	10.84151
	Std. Error	0.00380	0.00314	1.59697	1.39963
	Skewness	-0.21880	0.78384	-0.32503	1.32669
	Kurtosis	-0.09862	-0.00006	2.09816	0.92462
B	Cases	61	61	61	61
	Minimum	-0.44600	0.00100	-113.20750	0.54790
	Maximum	0.18700	0.44600	24.00000	113.20750
	Mean	-0.04782	0.06251	-18.05073	20.28806
	Std. Dev.	0.09045	0.08083	23.91893	22.02065
	Std. Error	0.01158	0.01035	3.06250	2.81946
	Skewness	-1.99550	2.93039	-1.80325	2.26822
	Kurtosis	7.26511	9.40849	4.64537	6.23438
C	Cases	72	72	72	72
	Minimum	-0.10900	0.00200	-45.16130	0.47960
	Maximum	0.24200	0.24200	48.27590	48.27590
	Mean	-0.00757	0.04021	-6.16318	11.64860
	Std. Dev.	0.05563	0.03891	14.86087	11.03469
	Std. Error	0.00656	0.00459	1.75137	1.30045
	Skewness	1.71269	2.40902	0.12394	1.59574
	Kurtosis	4.83983	8.62397	2.25045	2.29043
D	Cases	72	72	72	72
	Minimum	-0.11800	0.00200	-41.69180	0.65250
	Maximum	0.12400	0.12400	24.00000	41.69180
	Mean	-0.03136	0.03914	-12.59858	13.96490
	Std. Dev.	0.03395	0.02443	12.12244	10.49516
	Std. Error	0.00400	0.00288	1.42864	1.23687
	Skewness	1.26306	1.19681	-0.08203	0.66097
	Kurtosis	5.17016	1.99452	0.15337	-0.48202

DIFF = Radian NMOC concentration - QAD concentration, ppmC.
ADIFF = Absolute value of DIFF.
PDIFF = DIFF/((Radian NMOC conc. + QAD NMOC conc.)/2) x 100.
APDIFF = Absolute value of PDIFF.

TABLE 4-9. SUMMARY STATISTICS OF COMPARATIVE ANALYSES FOR RADIAN VS. AREAL CHANNELS

Statistics	Variables DIFF	 ADIFF	 PDIFF	 APDIFF
Cases	29	29	29	29
Minimum	-0.08800	0.00000	-5.55560	0.00000
Maximum	0.14200	0.14200	63.67710	63.67710
Mean	0.05245	0.07114	12.17135	13.95619
Standard Dev.	0.06287	0.03951	15.58129	13.94552
Standard Error	0.01168	0.00734	2.89337	2.58962
Skewness	-0.54910	-0.11230	1.42100	1.90813
Kurtosis	-0.91669	-1.12904	2.49849	4.06895

DIFF = Radian NMOC concentration - AREAL NMOC cocentration, ppmC.
ADIFF = Absolute value of DIFF.
PDIFF = DIFF/((Radian NMOC conc. + AREAL NMOC conc.)/2) x 100.
APDIFF = Absolute value of PDIFF.

TABLE 4-10. SUMMARY STATISTICS OF COMPARATIVE ANALYSES FOR RADIAN vs. AREAL CHANNELS, BY RADIAN CHANNELS

		Variables			
Channel	Statistics	DIFF	ADIFF	PCDIFF	APCDIFF
A	Cases	6	6	6	6
	Minimum	-0.03200	0.01800	-5.55560	1.74760
	Maximum	0.14200	0.14200	63.67710	63.67710
	Mean	0.06000	0.07667	19.06332	21.49772
	Std. Dev.	0.07009	0.04669	25.50778	23.06852
	Std. Error	0.02862	0.01906	10.41351	9.41768
	Skewness	-0.35565	0.05469	0.87667	1.12737
	Kurtosis	-1.40392	-1.21784	-0.42442	-0.11732
B	Cases	6	6	6	6
	Minimum	-0.03500	0.01800	-3.37020	3.16340
	Maximum	0.11800	0.11800	43.90240	43.90240
	Mean	0.05117	0.06883	11.46360	13.64147
	Std. Dev.	0.06679	0.04378	17.64351	15.67428
	Std. Error	0.02727	0.01787	7.20293	6.39900
	Skewness	-0.27044	0.05503	1.08985	1.39529
	Kurtosis	-1.60276	-1.75274	-0.01560	0.46362
C	Cases	8	8	8	8
	Minimum	-0.04400	0.01700	-2.99030	2.41630
	Maximum	0.11200	0.11200	27.25880	27.25880
	Mean	0.04988	0.06513	8.17445	9.52610
	Std. Dev.	0.05614	0.03388	9.88906	8.39349
	Std. Error	0.01985	0.01198	3.49631	2.96755
	Skewness	-0.62645	-0.12212	0.72587	1.24650
	Kurtosis	-1.03630	-1.35774	-0.20380	0.48578
D	Cases	9	9	9	9
	Minimum	-0.08800	0.00000	-4.79300	0.00000
	Maximum	0.13200	0.13200	20.81130	20.81130
	Mean	0.05056	0.07433	11.60134	13.07619
	Std. Dev.	0.07187	0.04271	10.51643	8.34567
	Std. Error	0.02396	0.01424	3.50548	2.78189
	Skewness	-0.77532	-0.53598	-0.69804	-0.69006
	Kurtosis	-0.54871	-0.73919	-1.38054	-1.32778

DIFF = Radian NMOC concentration - AREAL concentration, ppmC.
ADIFF = Absolute value of DIFF.
PDIFF = DIFF/((Radian NMOC conc. + AREAL NMOC conc.)/2) x 100.
APDIFF = Absolute value of PDIFF.

TABLE 4-11. SUMMARY STATISTICS OF COMPARATIVE ANALYSES FOR QAD VS. AREAL CHANNELS

Statistics	Variables			
	DIFF	ADIFF	PDIFF	APDIFF
Cases	12	12	12	12
Minimum	-0.21000	0.00900	-16.74640	0.88890
Maximum	0.19900	0.21000	16.19860	16.74640
Mean	0.00483	0.08250	1.96783	7.84682
Standard Dev.	0.11364	0.07426	9.57992	5.36929
Standard Error	0.03281	0.02144	2.76549	1.54998
Skewness	-0.50045	0.75914	-0.37075	0.55157
Kurtosis	-0.10199	-0.94496	-0.52788	-1.12745

DIFF = QAD NMOC concentration - AREAL NMOC cocentration, ppmC.
ADIFF = Absolute value of DIFF.
PDIFF = DIFF/((QAD NMOC conc. + AREAL NMOC conc.)/2) x 100.
APDIFF = Absolute value of PDIFF.

TABLE 4-12. SUMMARY STATISTICS FOR COMPARATIVE ANALYSES ON RADIAN CHANNELS

Statistics	Variables			
	DIFF	ADIFF	PDIFF	APDIFF
Cases	156	156	156	156
Minimum	-0.18600	0.00000	-76.99115	0.00000
Maximum	0.26800	0.26800	57.09156	76.99115
Mean	0.00174	0.03172	-0.01912	8.24163
Standard Dev.	0.05571	0.04576	14.68051	12.13075
Standard Error	0.00446	0.00366	1.17538	0.97124
Skewness	0.98957	3.01029	-0.40132	3.26699
Kurtosis	8.08381	10.12834	9.41101	11.71517

DIFF = NMOC concentration on Channel Y - NMOC concentration on Channel X, ppmC.
ADIFF = Absolute value of DIFF.
PDIFF = DIFF/((NMOC concentration on Channel Y + NMOC concentration on Channel X)/2) x 100.
APDIFF = Absolute value of PDIFF.

TABLE 4-13. SUMMARY STATISTICS FOR COMPARATIVE ANALYSES ON RADIAN CHANNELS, BY CHANNEL PAIRS

		Variables			
Channel Pair	Statistics	DIFF	ADIFF	PCDIFF	APCDIFF
A-A	Cases	32	32	32	32
	Minimum	-0.03500	0.00100	-18.68512	0.19066
	Maximum	0.20100	0.20100	54.25101	54.25101
	Mean	0.00947	0.02484	1.55887	7.33285
	Std. Dev.	0.04263	0.03567	11.91380	9.43090
	Std. Error	0.00754	0.00631	2.10608	1.66716
	Skewness	2.94114	3.92627	2.62901	4.03023
	Kurtosis	10.83975	16.89304	10.17673	17.52028
B-A	Cases	1	1	1	1
	Minimum	-0.02200	0.02200	-14.37908	14.37908
	Maximum	-0.02200	0.02200	-14.37908	14.37908
	Mean	-0.02200	0.02200	-14.37908	14.37908
	Std. Dev.	-	-	-	-
	Std. Error	-	-	-	-
	Skewness	-	-	-	-
	Kurtosis	-	-	-	-
B-B	Cases	42	42	42	42
	Minimum	-0.18600	0.00100	-76.99115	0.22247
	Maximum	0.26800	0.26800	57.02128	76.99115
	Mean	0.00219	0.04490	-1.00282	12.19596
	Std. Dev.	0.08292	0.06939	22.30106	18.60102
	Std. Error	0.01280	0.01071	3.44113	2.87020
	Skewness	0.73208	2.10357	-1.01309	1.99297
	Kurtosis	4.07878	3.33338	3.67384	3.06927
C-C	Cases	45	45	45	45
	Minimum	-0.12900	0.00100	-24.73118	0.31104
	Maximum	0.07700	0.12900	16.11805	24.73118
	Mean	-0.01024	0.02900	-1.37861	6.48480
	Std. Dev.	0.04070	0.03007	8.68004	5.85478
	Std. Error	0.00607	0.00448	1.29394	0.87278
	Skewness	-0.65008	1.42338	-0.39580	1.10550
	Kurtosis	0.96431	1.69111	0.30422	0.88705

(Continued)

TABLE 4-13. (Continued)

Channel Pair	Statistics	DIFF	ADIFF	PCDIFF	APCDIFF
C-D	Cases	1	1	1	1
	Minimum	-0.01800	0.01800	-2.52809	2.52809
	Maximum	-0.01800	0.01800	-2.52809	2.52809
	Mean	-0.01800	0.01800	-2.52809	2.52809
	Std. Dev.	-	-	-	-
	Std. Error	-	-	-	-
	Skewness	-	-	-	-
	Kurtosis	-	-	-	-
D-B	Cases	1	1	1	1
	Minimum	0.15900	0.15900	57.09156	57.09156
	Maximum	0.15900	0.15900	57.09156	57.09156
	Mean	0.15900	0.15900	57.09156	57.09156
	Std. Dev.	-	-	-	-
	Std. Error	-	-	-	-
	Skewness	-	-	-	-
	Kurtosis	-	-	-	-
D-D	Cases	34	34	34	34
	Minimum	-0.05200	0.00000	-17.87709	0.00000
	Maximum	0.09700	0.09700	19.67621	19.67621
	Mean	0.00641	0.02247	0.32662	5.08818
	Std. Dev.	0.03260	0.02419	7.00108	4.73824
	Std. Error	0.00559	0.00415	1.20068	0.81260
	Skewness	0.98416	1.54196	0.22654	1.43498
	Kurtosis	1.02816	1.74113	1.10642	2.04483

DIFF = NMOC concentration on Channel X - NMOC concentration on Channel Y, ppmC.
ADIFF = Absolute value of DIFF.
PDIFF = DIFF/((NMOC concentration on Channel X + NMOC concentration on Channel Y)/2) x 100.
APDIFF = Absolute value of PDIFF.

TABLE 4-14. 95% CONFIDENCE INTERVALS FOR MEAN DELTA, REPEATED ANALYSES

Channel Pair	Mean Difference (ppmC)	Standard Deviation (ppmC)	Cases	$t_{0.975,n-1}$	95% Confidence Intervals Upper	Lower
A-A	0.00947	0.04263	32	2.040	0.02484	-0.00590
B-B	0.00219	0.08292	42	2.020	0.02804	-0.02366
C-C	-0.01024	0.04070	45	2.017	0.00200	-0.02248
D-D	0.00641	0.03260	34	2.036	0.01779	-0.00497

$t_{0.975,n-1}$ = Student's t-statistic for 95% confidence interval, where n = the number of cases in mean DIFF.

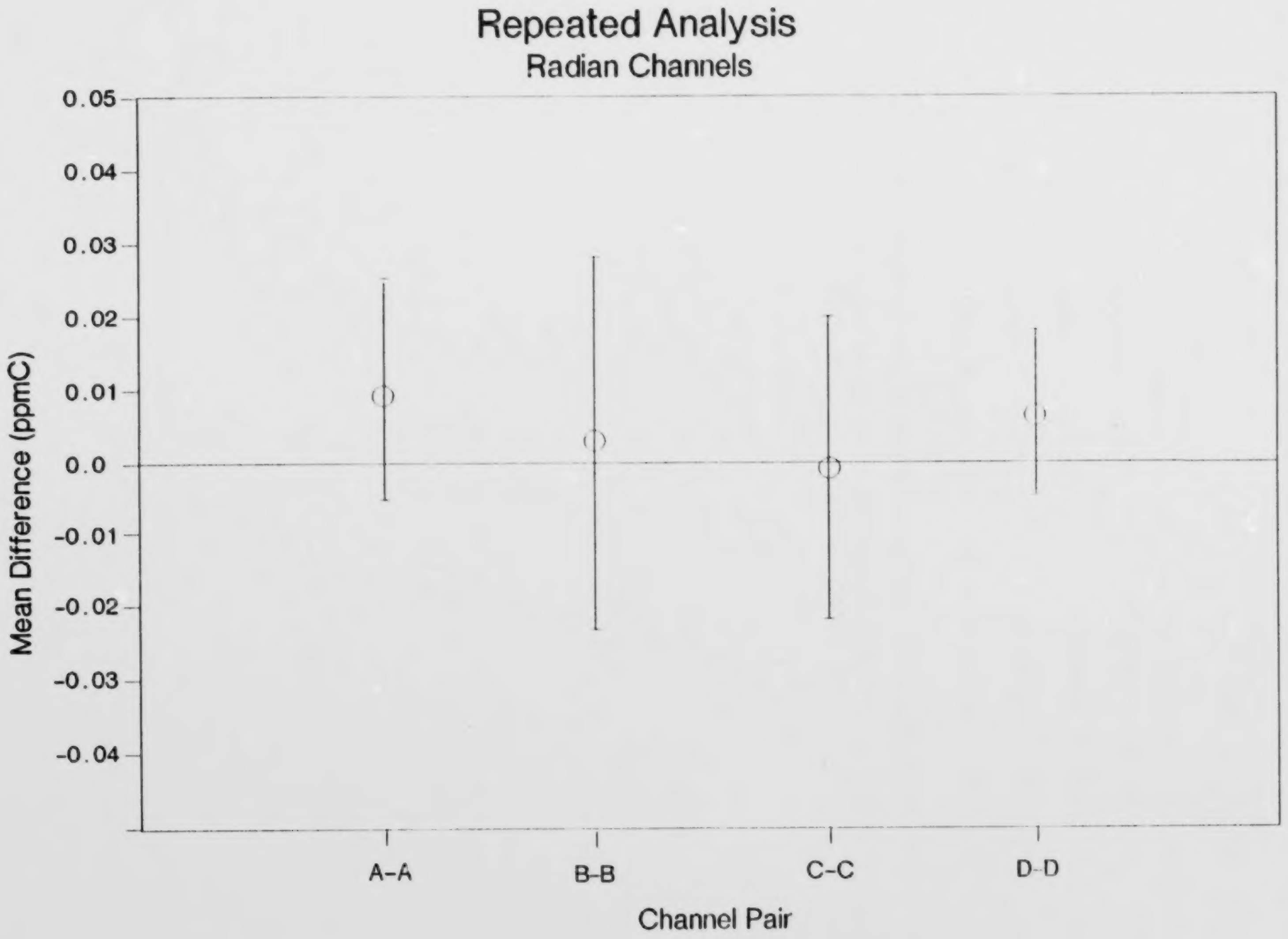

Figure 4-25. 95% Confidence intervals for mean NMOC difference.

4.4.2 Quality Control Chart

A quality control chart was developed for the 1989 replicate analyses and is shown in Figure 4-26. The control chart plots percent difference for the replicate analyses versus Julian date, 1989. The mean line, μ, which is nearly coincident with zero, and two sets of horizontal control lines are shown. Control lines at $\mu \pm 2\sigma$ and $\mu \pm 3\sigma$ are shown on the quality control chart. The percent difference for the control chart is defined as:

% difference = ((NMOC for 2nd analysis - NMOC for 1st analysis) / (Mean NMOC for both analyses)) * 100.

The 2-σ limits, i.e., $\mu \pm 2\sigma$, are termed the warning limits; the 3-σ limits, $\mu \pm 3\sigma$, are called the control limits. The control chart was consulted frequently to see if consecutive replicate determinations were outside the warning or control limits. In only one instance, about 1989 Julian date 270, did consecutive determinations occur outside the warning limits or control limits. More than two consecutive determinations outside the warning limits or the 3-σ limits give some cause for concern and may indicate that something is out of control in the sampling and/or analytical system. As seen in the control chart, in no case was the sampling and/or analytical system out of control. To investigate the nature of the imprecision, or percent difference, the data were examined to determine if percent difference was a function of the average NMOC concentration level. This analysis is given in Section 4.4.3.

4.4.3 Precision Profile

The replicate percent differences were plotted against average NMOC concentration for the replicate pair, and are shown in Figure 4-27. It is clear from the figure that as the NMOC concentration decreases, the imprecision increases. One of the major causes of imprecision at lower concentrations is instrument noise. Since instrument noise is essentially independent of NMOC concentration, the portion of response attributed to noise increases at lower NMOC concentrations. These facts combine to show an increased imprecision at lower NMOC concentrations.

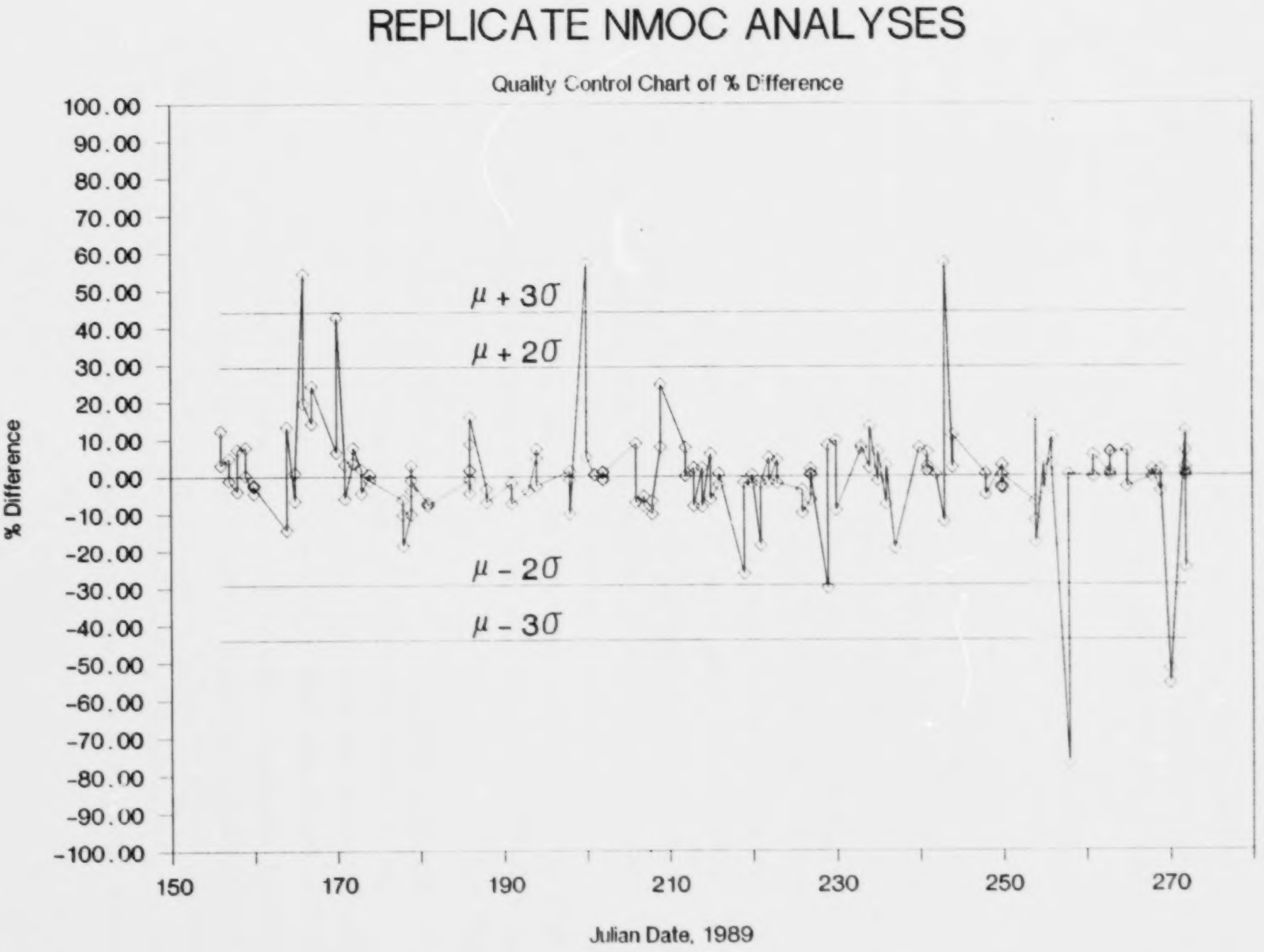

Figure 4-26. Quality control chart of percent difference for replicate NMOC analyses.

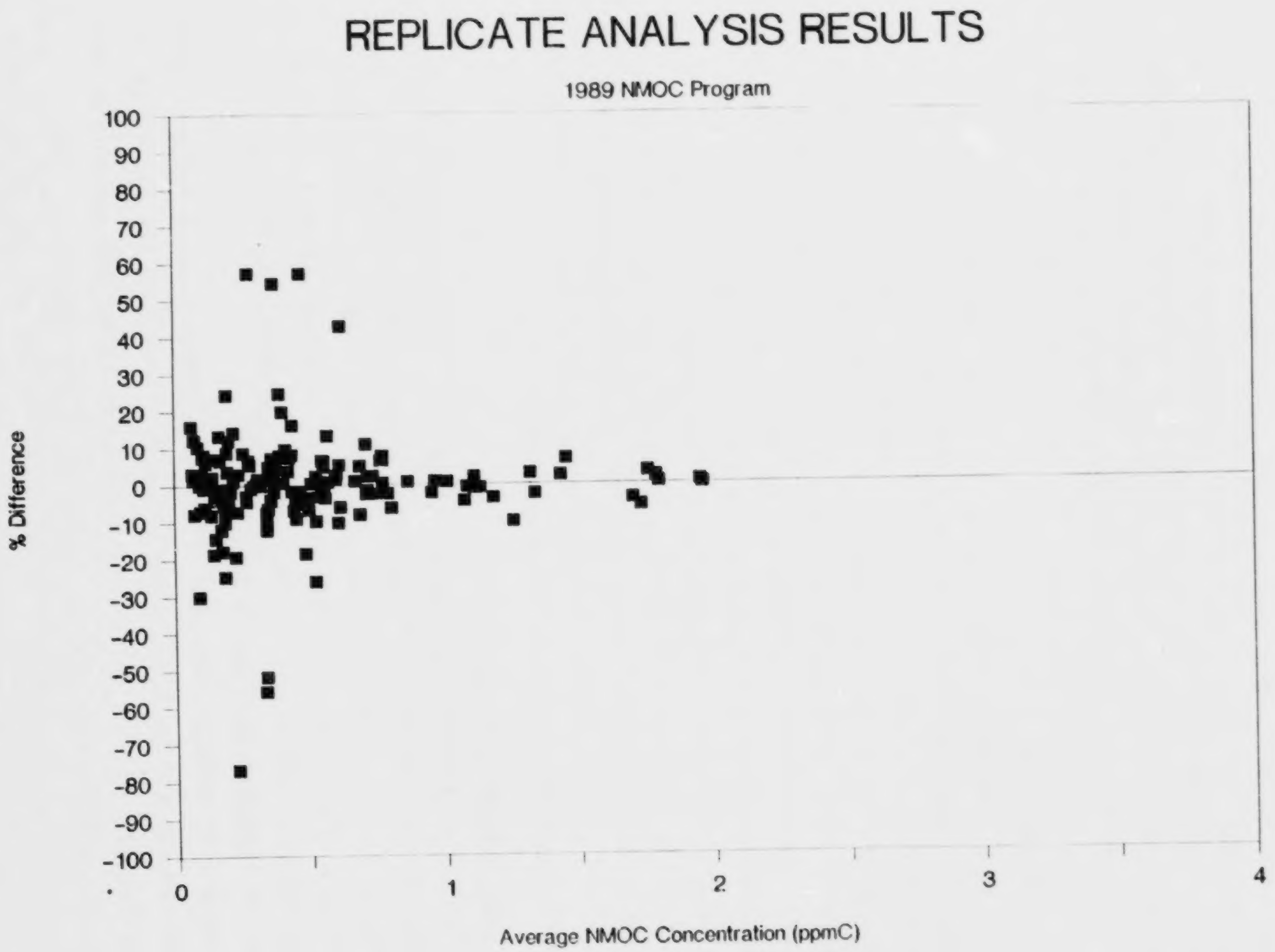

Figure 4-27. Replicate NMOC analysis results comparing average concentration with percent difference.

The NMOC concentration and percent difference for 156 replicate analyses were sorted by NMOC concentration and divided into the eleven NMOC size groups shown in Table 4-15. In the table, below 1.0 ppmC, the size increments are 0.100 ppmC, and show average NMOC concentration (assuming random variable, normally distributed), minimum percent difference, average percent difference, average absolute percent difference, and maximum percent difference for each NMOC size group. The data in the table are plotted in Figures 4-28 and 4-29.

Figure 4-28 shows large fluctuations of average percent difference at the lower NMOC concentrations. At higher NMOC concentrations, the average percent difference is below 2.0 percent. A more striking profile of the replicate precision is seen in Figure 4-29 in which average absolute percent difference is shown to decrease dramatically as the NMOC concentration increases. When the NMOC concentration increases above 0.75 ppmC, the average absolute percent difference levels off at about 3 to 4 percent. Overall average absolute percent difference for all 156 replicates is seen (Figure 4-29) to be about 8.24 percent, which is a very good precision.

This analysis shows that as the NMOC concentration decreases the imprecision of the measurement increases dramatically. Similar results are universally found in analytical instrumentation.

4.4.4 Local Ambient Samples

Table 4-16 presents the overall statistics for local ambient samples. These data include comparisons among Radian channels and EPA channels. The mean differences and the mean percent differences are both relatively small, which indicates that they are random variables. The overall mean absolute percent difference (APDIFF) is 11.05%, which is slightly higher than the precision for repeated analyses (8.24%).

Table 4-17 presents the same information comparing each Radian channel to the QAD results and to other Radian channels. Note from the definition of percent difference, PCDIFF, in this table that the Radian-QAD comparisons are different from a definition of bias, using QAD as the reference. The statistic used to normalize PCDIFF in Table 4-17 is the average of the Radian NMOC and the QAD NMOC, whereas for a bias term, the QAD NMOC is used to normalize the PCDIFF.

TABLE 4-15. 1989 NMOC REPLICATE IMPRECISION

Cases	NMOC Range	Average NMOC ppmC	Minimum % DIFF	Average %DIFF	Absolute %DIFF	Maximum %DIFF
9	0.000-0.099	0.050	-30.168	-0.265	9.788	15.873
31	0.100-0.199	0.150	-24.731	-2.005	7.953	24.289
18	0.200-0.299	0.250	-76.991	-0.564	12.651	57.092
21	0.300-0.399	0.350	-55.689	-1.888	12.446	54.251
17	0.400-0.499	0.450	-18.667	5.284	10.832	57.021
17	0.500-0.599	0.550	-26.170	-0.908	5.120	13.169
8	0.600-0.699	0.650	-10.353	3.951	10.117	42.718
11	0.700-0.799	0.750	-2.667	2.402	4.084	10.837
5	0.800-0.999	0.900	-6.460	-1.397	2.108	0.620
12	1.000-1.499	1.250	-10.267	-0.852	3.191	6.664
7	1.500-1.999	1.750	-5.938	-0.552	2.302	3.126
Overall			-76.991	-0.019	8.242	57.092

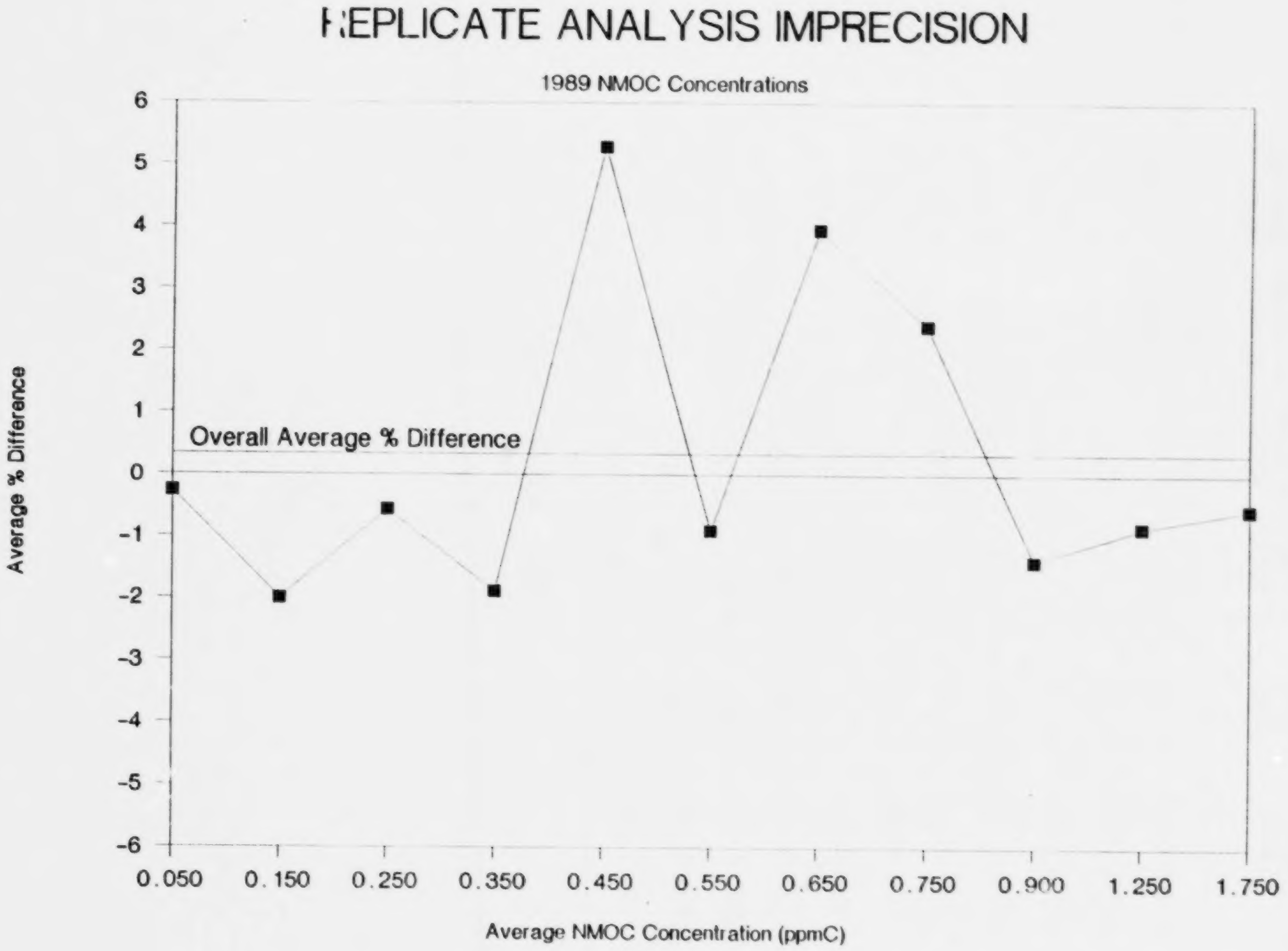

Figure 4-28. Replicate NMOC analysis results comparing average concentration with average percent difference.

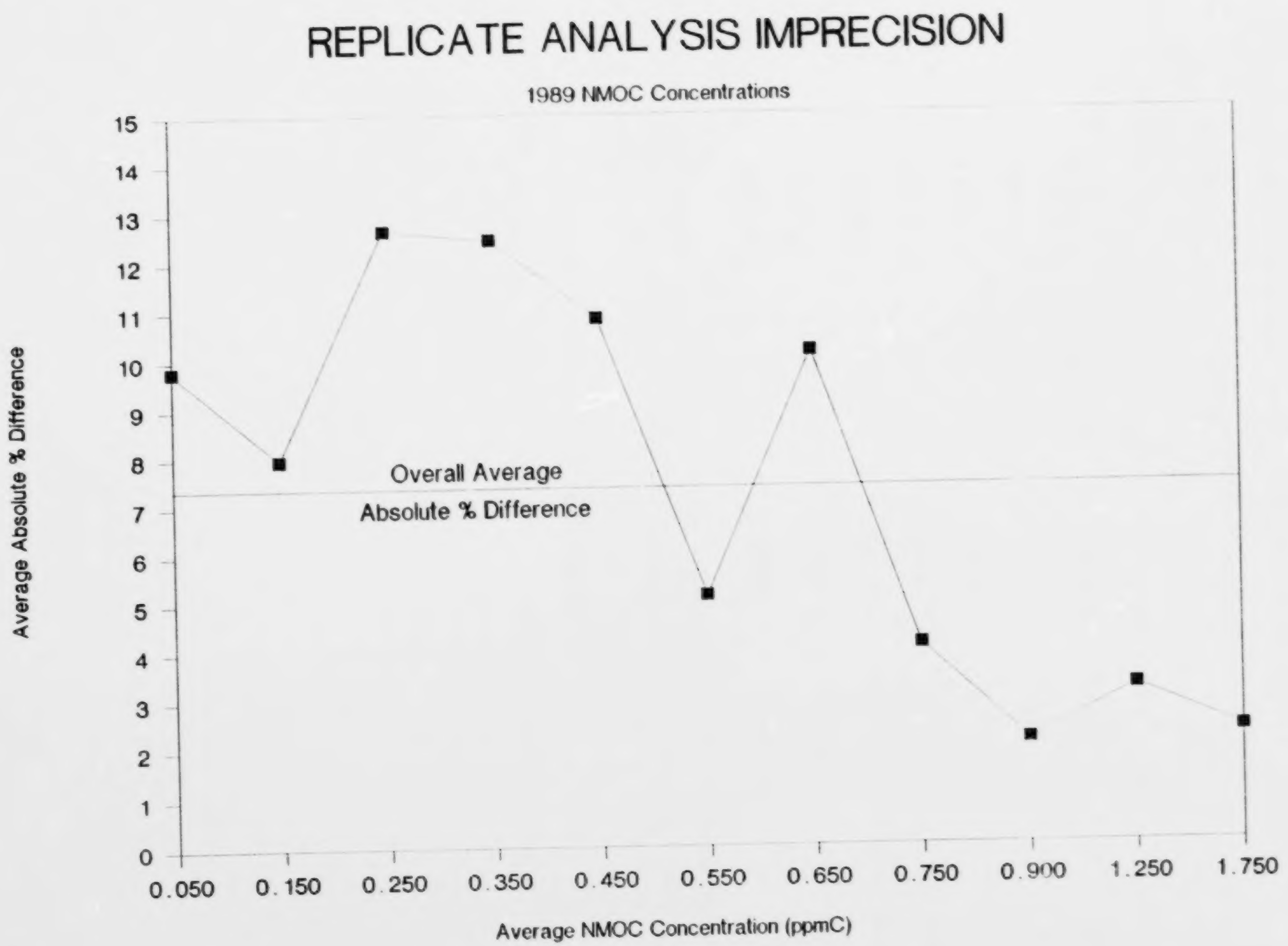

Figure 4-29. Replicate NMOC analysis results comparing average concentration with average absolute percent difference.

TABLE 4-16. OVERALL STATISTICS FOR LOCAL AMBIENT SAMPLES

Statistics	DIFF	ADIFF	PDIFF	APDIFF
Cases	280	280	280	280
Minimum	-0.14600	0.00000	-63.47830	0.00000
Maximum	0.12850	0.14600	53.95350	63.47830
Mean	-0.00495	0.02390	-3.23343	11.05245
Standard Dev.	0.03593	0.02724	15.68687	11.57448
Standard Error	0.00217	0.00164	0.94595	0.69797
Skewness	0.36379	2.11966	0.10861	1.74367
Kurtosis	3.86291	4.82087	2.45216	2.96128

DIFF = NMOC concentration on Channel Y - NMOC concentration on Channel X, ppmC.
ADIFF = Absolute value of DIFF.
PDIFF = DIFF/((NMOC concentration on Channel Y + NMOC concentration on Channel X)/2) x 100.
APDIFF = Absolute value of PDIFF.

TABLE 4-17. STATISTICS FOR LOCAL AMBIENT SAMPLES, BY CHANNEL PAIR

Channel Pair (X-Y)	Statistics	Variables			
		DIFF	ADIFF	PCDIFF	APCDIFF
A-QAD	Cases	28	28	28	28
	Minimum	-0.10100	0.00000	-48.98340	0.00000
	Maximum	0.00900	0.10100	33.96230	43.98340
	Mean	-0.02130	0.02288	-8.83435	11.67844
	Std. Dev.	0.02596	0.02454	15.14308	12.99276
	Std. Error	0.00491	0.00464	2.86177	2.45540
	Skewness	-1.36534	1.57932	-0.12444	1.18721
	Kurtosis	1.65481	2.19975	1.62467	0.14101
B-QAD	Cases	28	28	28	28
	Minimum	-0.14600	0.00100	-63.47830	0.54790
	Maximum	0.05400	0.14600	24.00000	63.47830
	Mean	-0.02886	0.03314	-13.89000	16.12552
	Std. Dev.	0.04050	0.03695	17.58961	15.48576
	Std. Error	0.00765	0.00698	3.32412	2.92653
	Skewness	-1.33754	1.86631	-0.82276	1.41816
	Kurtosis	2.32637	2.73998	1.26396	1.63055
C-QAD	Cases	28	28	28	28
	Minimum	-0.06200	0.00200	-43.35660	0.47960
	Maximum	0.10400	0.10400	48.27590	48.27590
	Mean	-0.01146	0.02482	-7.32042	13.14589
	Std. Dev.	0.03115	0.02162	16.52604	12.22573
	Std. Error	0.00589	0.00409	3.12313	2.31045
	Skewness	2.02745	1.88683	0.95764	1.41498
	Kurtosis	5.33011	4.60223	3.24719	1.47351
D-QAD	Cases	28	28	28	28
	Minimum	-0.06600	0.00200	-30.53440	2.11360
	Maximum	0.04390	0.06600	24.00000	30.53440
	Mean	-0.02561	0.02932	-11.53140	14.18255
	Std. Dev.	0.02186	0.01634	12.02604	8.59821
	Std. Error	0.00413	0.00309	2.27271	1.62491
	Skewness	0.89638	0.38031	0.73319	0.48702
	Kurtosis	2.15813	-0.25904	1.08097	-1.13109

(Continued)

TABLE 4-17. (Continued)

		Variables			
Channel Pair (X-Y)	Statistics	DIFF	ADIFF	PCDIFF	APCDIFF
B-A	Cases	28	28	28	28
	Minimum	-0.13500	0.00100	-46.48190	0.21460
	Maximum	0.06850	0.13500	18.35750	46.48190
	Mean	-0.00859	0.02184	-5.69156	9.11804
	Std. Dev.	0.03882	0.03299	13.97553	11.94535
	Std. Error	0.00734	0.00624	2.64113	2.25746
	Skewness	-1.54903	2.26453	-1.50969	2.05067
	Kurtosis	3.89048	4.42489	2.39299	3.41904
C-A	Cases	28	28	28	28
	Minimum	-0.04100	0.00100	-30.94340	0.20960
	Maximum	0.12850	0.12850	29.89470	30.94340
	Mean	0.01150	0.02217	2.25764	8.96954
	Std. Dev.	0.03638	0.03083	12.18073	8.37355
	Std. Error	0.00700	0.00593	2.34418	1.61149
	Skewness	1.78022	2.27091	-0.43356	1.19267
	Kurtosis	3.19496	4.52118	1.05317	0.86967
C-B	Cases	28	28	28	28
	Minimum	-0.03900	0.00100	-29.65780	0.47060
	Maximum	0.11800	0.11800	53.95350	53.95350
	Mean	0.02070	0.02826	8.17945	12.88185
	Std. Dev.	0.04107	0.03609	18.46039	15.42525
	Std. Error	0.00790	0.00694	3.55270	2.96859
	Skewness	1.28062	1.58497	0.86639	1.46501
	Kurtosis	0.77340	1.22859	0.88956	0.92616
C-D	Cases	28	28	28	28
	Minimum	-0.02500	0.00000	-20.08030	0.00000
	Maximum	0.06900	0.06900	25.00000	25.00000
	Mean	0.01549	0.01911	4.83526	7.74036
	Std. Dev.	0.02152	0.01823	8.54536	5.92323
	Std. Error	0.00414	0.00351	1.64456	1.13993
	Skewness	0.65930	1.19026	-0.72347	1.18709
	Kurtosis	0.32845	0.78246	2.20795	1.34482

(Continued)

TABLE 4-17. (Continued)

Channel Pair (X-Y)	Statistics	Variables DIFF	 ADIFF	 PCDIFF	 APCDIFF
D-A	Cases	28	28	28	28
	Minimum	-0.03600	0.00000	-19.54890	0.00000
	Maximum	0.05950	0.05950	20.09570	20.09570
	Mean	-0.00399	0.01661	-2.58031	7.33664
	Std. Dev.	0.02186	0.01443	8.87573	5.45857
	Std. Error	0.00421	0.00278	1.70813	1.05050
	Skewness	1.19512	1.12369	0.68968	0.81149
	Kurtosis	1.36664	1.02858	0.46638	0.03207
D-B	Cases	28	28	28	28
	Minimum	-0.03200	0.00000	-9.72220	0.00000
	Maximum	0.11000	0.11000	40.60910	40.60910
	Mean	0.00522	0.02907	3.39327	9.01275
	Std. Dev.	0.03534	0.02907	14.87646	12.20297
	Std. Error	0.00680	0.00559	2.86298	2.34846
	Skewness	1.87203	1.96331	1.69810	1.82801
	Kurtosis	2.46241	2.74915	1.46388	1.84601

DIFF = NMOC concentration on Channel Y - NMOC concentration on Channel X, ppmC.

ADIFF = Absolute value of DIFF.

PDIFF = DIFF/((NMOC concentration on Channel X + NMOC concentration on Channel Y)/2) x 100.

APDIFF = Absolute value of PDIFF.

Table 4-18 adds the 95% confidence intervals for the local ambient sample comparisons of the mean values of DIFF (from Table 4-17). Figure 4-30 displays the results of Table 4-18 graphically. Table 4-19 compares the percent differences for the several channel pairs for the site samples and the local ambient samples. For all comparisons, with the exception of C-B, A-QAD, and C-QAD, the percent differences appear to be slightly greater for the site samples than for the local ambient samples.

4.5 DUPLICATE SAMPLE RESULTS

Throughout the 1989 NMOC Monitoring Program, duplicate samples were collected once every two weeks at each site. Each duplicate was analyzed by Radian for its NMOC content.

Table 4-20 summarizes the duplicate sample statistics for NMOC, DIFF, ADIFF, PDIFF, and APDIFF. The mean absolute percent difference between the duplicate samples was 10.62 percent. The absolute percent difference ranged from zero to 80.5 percent. Table 4-21 summarizes the statistics for duplicate analyses by site code. The mean absolute percentage differences between duplicates ranged from 2.88% for LXKY to 29.15% for ELCA.

These results are higher than those found in 1988, but still represent good overall precision. The analytical error in 1988 for repeated analys was 10.06%, while the precision for duplicates was 8.72 percent. Because the duplicate results include sampling and analysis precision, while the replicate (or repeated analysis) precision relates only to analytical error, the duplicate absolute percent difference is expected to be greater than the replicate absolute percent difference.

4.5.1 Sampling and Analysis Precision

For 75 duplicate ambient air samples, replicate analyses were performed. Each reported analysis was the average of two or three injections of sample into the PDFID instrument. For the determination described below, each injection (rather than the average of two or three injections) was used as a statistic for determining analytical error. The replicate analyses of the duplicate samples were performed on sucessive days. That is, the first analysis, consisting of two or three injections from a duplicate canister, was performed on the day the duplicate canisters were received from a particular

TABLE 4-18. LOCAL AMBIENT SAMPLES CONFIDENCE INTERVALS

Channel Pair (X-Y)	Mean Difference (ppmC)	Standard Deviation (ppmC)	Cases	$t_{0.975,n-1}$	95% Confidence Intervals Upper	Lower
A-QAD	-0.02130	0.02596	28	2.052	-0.01123	-0.03137
B-QAD	-0.02886	0.04050	28	2.052	-0.01315	-0.04457
C-QAD	-0.01146	0.03115	28	2.052	-0.00062	-0.02354
D-QAD	-0.02561	0.02186	28	2.052	-0.01713	-0.03409
B-A	-0.00859	0.03882	28	2.052	0.00643	-0.02361
C-A	0.01150	0.03638	28	2.052	0.02558	-0.00258
C-B	0.02070	0.04107	28	2.052	0.03660	0.00480
C-D	0.01549	0.02152	28	2.052	0.02382	0.00716
D-A	-0.00399	0.02186	28	2.052	0.00447	-0.01245
D-B	0.00522	0.03534	28	2.052	0.01890	-0.00846

$t_{0.975,n-1}$ = Student's t-statistic for 95% confidence interval, where n = the number of cases in mean DIFF.

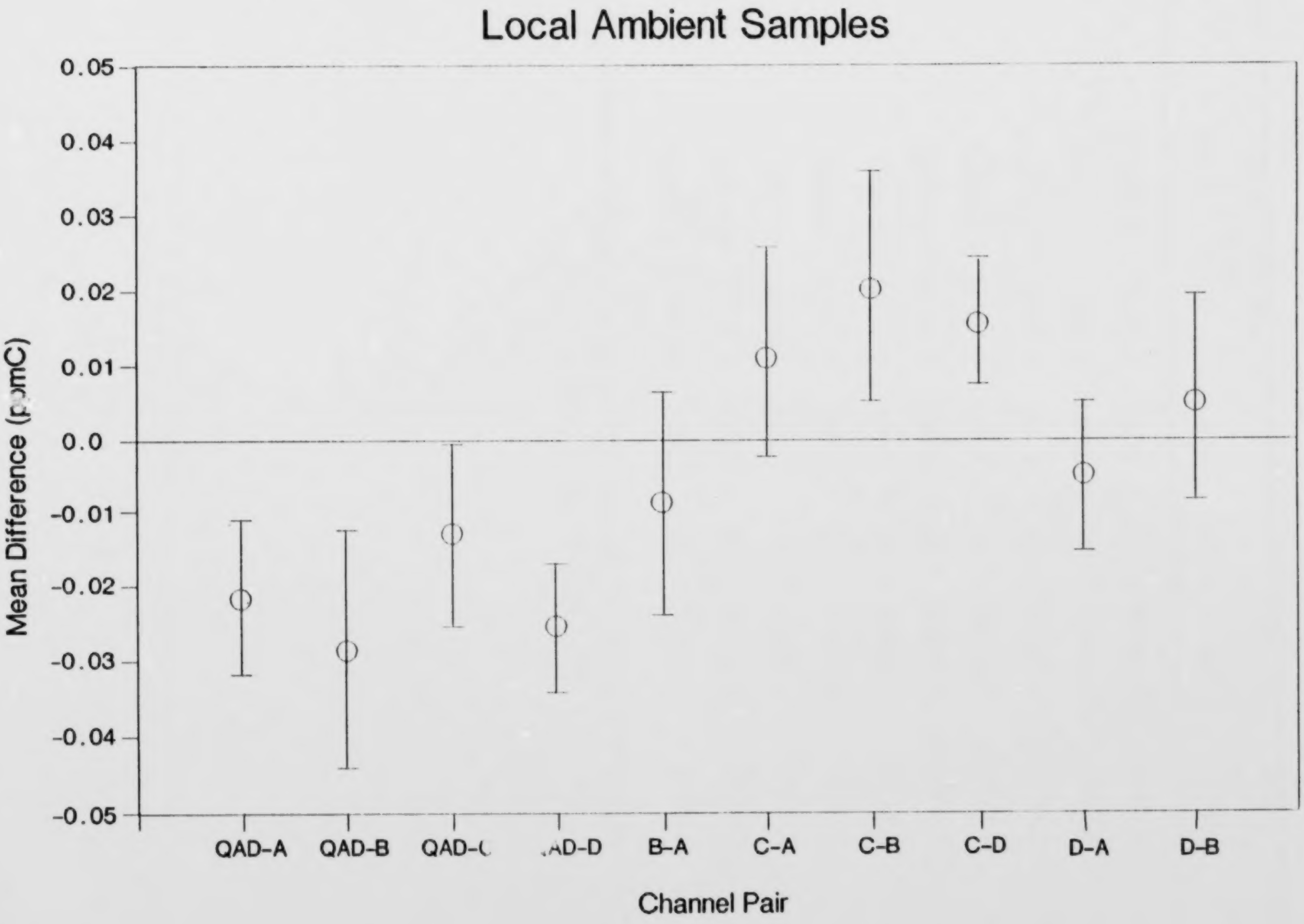

Figure 4-30. 95% Confidence intervals for mean NMOC difference.

TABLE 4-19. COMPARISON OF PERCENT DIFFERENCE IN NMOC CONCENTRATION BETWEEN CHANNEL PAIRS

Channel Pair (X-Y)	Site Samples Percent Difference Mean	Site Samples Percent Difference Standard Deviation	Site Samples Cases	Local Ambient Samples Percent Difference Mean	Local Ambient Samples Percent Difference Standard Deviation	Local Ambient Samples Cases
B-A	-13.25688	23.64949	13	-5.69156	13.97553	28
C-A	4.44166	19.90356	17	2.25764	12.18073	28
C-B	8.08086	14.29609	27	8.17945	18.46039	28
C-D	5.42850	14.18093	21	4.83526	8.54536	28
D-A	2.15075	14.25620	16	-2.58031	8.87573	28
D-B	3.08943	17.41362	23	3.39327	14.87646	28
A-QAD	-8.21561	12.37010	60	-8.83435	15.14308	28
B-QAD	-18.05073	23.91893	61	-13.89000	17.58961	28
C-QAD	-6.16318	14.86087	72	-7.32042	16.52604	28
D-QAD	-12.59858	12.12244	72	-11.53140	12.02604	28

% Difference = (NMOC (X) - NMOC (Y)) / ((NMOC (X) + NMOC (Y)) / 2) * 100

TABLE 4-20. STATISTICS FOR DUPLICATE ANALYSIS

Statistics	Variables NMOC	DIFF	ADIFF	PDIFF	APDIFF
Cases	181	181	181	181	181
Minimum	0.04850	-0.37600	0.00000	-80.51390	0.00000
Maximum	2.81950	0.41300	0.41300	71.54470	80.51390
Mean	0.54618	0.01505	0.04448	4.24458	10.62149
Standard Dev.	0.44515	0.07811	0.06588	17.22531	14.19102
Standard Error	0.03309	0.00581	0.00490	1.28035	1.05481
Skewness	1.83473	0.65604	3.11126	0.65214	2.52250
Kurtosis	4.22508	9.29811	11.36843	5.77036	6.97082

NMOC = Average NMOC concentration of duplicate samples, ppmC.
DIFF = Difference between NMOC concentrations for duplicate samples, ppmC.
ADIFF = Absolute value of DIFF.
PDIFF = DIFF/((NMOC concentration for duplicate 1 + NMOC concentration for duplicate 2)/2) x 100.
APDIFF = Absolute value of PDIFF.

TABLE 4-21. DUPLICATE ANALYSES STATISTICS, BY SITE

Site Code	NMOC, ppmC		ADIFF, ppmC		APDIFF, ppmC		Dup. Pairs
	Mean	SD	Mean	SD	Mean	SD	
ALCA	0.19033	0.23943	0.02111	0.02848	13.96249	13.86315	9
BACA	0.71422	0.37356	0.09733	0.13456	14.82464	17.20990	9
BMTX	0.85522	0.50058	0.05467	0.04629	7.60719	7.88346	9
C3IL	0.22596	0.14825	0.01219	0.00902	7.91159	6.94458	7
C6IL	0.98136	0.54669	0.04786	0.06376	7.00376	10.59426	7
DLTX	0.46469	0.22671	0.06688	0.11841	14.06729	23.79612	8
ELCA	0.59596	0.34278	0.09493	0.14461	17.07223	29.14641	8
ELTX	0.31621	0.16184	0.02471	0.02666	8.72313	8.91677	8
FECA	0.44213	0.19251	0.06800	0.05870	15.28104	14.24468	8
GRMI	0.54258	0.21330	0.03917	0.04976	6.96135	6.14543	6
H1TX	0.81843	0.55971	0.07257	0.09379	13.90359	23.59036	7
LBCA	0.94786	0.63284	0.06286	0.09184	11.85637	20.47535	7
LXKY	0.46431	0.54815	0.01263	0.01004	3.81114	2.88262	8
M1NY	0.47006	0.19207	0.02688	0.02406	6.42121	5.27519	8
MGAL	0.23471	0.10354	0.03886	0.02706	19.76096	17.55192	7
MNY	0.55985	0.22494	0.04890	0.04696	8.88094	7.47697	10
NWNJ	0.47671	0.21336	0.04514	0.02898	11.80123	10.54608	7
PLNJ	0.59845	0.41449	0.03970	0.04496	9.79536	12.82757	10
RLNC	0.17717	0.12827	0.01933	0.01869	13.20125	10.86335	6
RSCA	1.28519	0.74066	0.02913	0.03072	3.43878	5.51916	8
S2MO	0.49364	0.15982	0.03643	0.04311	9.69097	16.22818	7
S3CA	0.24430	0.16460	0.02140	0.02512	7.72415	6.08258	10
S4CA	0.42913	0.46157	0.03375	0.05370	11.83333	19.22213	8

ADIFF = The absolute value of the difference between duplicates, ppmC.
APDIFF = ADIFF/((NMOC duplicate 1 + NMOC duplicate 2)/2)*100

site. After the first replicate analysis, the canister was disconnected from the PDFID instrument and set aside in the laboratory and analyzed for the second replicate analysis on the next day, or within 72 hours if the first analysis occurred on Friday.

Duplicate samples were taken simultaneously in 6-L stainless steel canisters connected to a tee, the stem of which was connected to the NMOC sampler manifold. All of the duplicate samples for which there were replicated analyses are listed in Table 4-22.

The number of injections per analysis was governed by the standard deviation of the NMOC results of the first two injections during each analysis. If the standard deviation was 0.02 ppmC or greater, a third injection was performed, otherwise only two injections were performed for each analysis.

The analyses of variance (ANOVAs) discussed in Tables 4-23 and 4-24 were designed to differentiate between the analytical error of the PDFID NMOC measurement, the effect of the replicate analyses, and the duplicate sample effect. The model for the ANOVA is given below:

$$Y_{ijkl} = \mu + S_i + D_{j(i)} + R_{k(ij)} + e_{l(ijk)},$$

Where:

Y_{ijkl} = NMOC concentration by PDFID analysis, ppmC;

μ = overall average NMOC concentration, ppmC;

S_i = ambient air sample effect, i=1,2...75 samples;

$D_{j(i)}$ = duplicate sample number for each ambient air sample, i, j = duplicate number = 1 or 2;

$R_{k(ij)}$ = replicate sample number, k, for each duplicate j and each ambient air sample i, r = replicate number = 1, 2; and

$e_{l(ijk)}$ = residual error, or analytical error, where l is the number of injections.

Variable effects $D_{j(i)}$, $R_{k(ij)}$, and $e_{l(ijk)}$ are all nested effects, and in this experiemental design there are no interaction terms. The residual mean-square error term is equal to the analytical error variance. The replicate

TABLE 4-22. REPLICATE ANALYSIS OF DUPLICATE SAMPLES FOR 1989

Sample No.	Site Code	Julian Date Sampled	Sample I.D. Number	Mean NMOC ppmC	Mean NMOC ppmC	Overall Mean	% Diff	Absolute % Diff	Sample Overall Mean	Duplicate % Diff.	Duplicate Abs. % Diff.
1	ALCA	156	1016	0.069	0.078	0.0735	12.24490	12.24490			
	ALCA	156	1017	0.065	0.067	0.0660	3.03030	3.03030	0.06975	-10.75269	10.75269
2	C6IL	157	1041	0.542	0.569	0.5555	4.86049	4.86049			
	C6IL	157	1042	0.553	0.547	0.5500	-1.09091	1.09091	0.55275	-0.99502	0.99502
3	ELCA	158	1066	0.152	0.146	0.1490	-4.02685	4.02685			
	ELCA	158	1067	0.148	0.159	0.1535	7.16612	7.16612	0.15125	2.97521	2.97521
4	PLNJ	159	1076	0.377	0.408	0.3925	7.89809	7.89809			
	PLNJ	159	1077	0.370	0.371	0.3705	0.26991	0.26991	0.38150	-5.76671	5.76671
5	MGAL	160	1113	0.207	0.198	0.2025	-4.44444	4.44444			
	MGAL	160	1114	0.184	0.180	0.1820	-2.19780	2.19780	0.19225	-10.66320	10.66320
6	DLTX	160	1131	0.802	0.782	0.7920	-2.52525	2.52525			
	DLTX	160	1132	0.760	0.740	0.7500	-2.66667	2.66667	0.77100	-5.44747	5.44747
7	S3CA	164	1159	0.164	0.142	0.1530	-14.37908	14.37908			
	S3CA	164	1160	0.155	0.177	0.1660	13.25301	13.25301	0.15950	8.15047	8.15047
8	S4CA	165	1191	0.205	0.192	0.1985	-6.54912	6.54912			
	S4CA	165	1192	0.217	0.219	0.2180	0.91743	0.91743	0.20825	9.36375	9.36375
9	C6IL	166	1207	0.270	0.471	0.3705	54.25101	54.25101			
	C6IL	166	1208	0.362	0.441	0.4015	19.67621	19.67621	0.38600	8.03109	8.03109
10	BACA	167	1242	0.204	0.235	0.2195	14.12301	14.12301			
	BACA	167	1243	0.170	0.217	0.1935	24.28941	24.28941	0.20650	-12.59080	12.59080
11	ELCA	170	1258	0.738	0.787	0.7625	6.42623	6.42623			
	ELCA	170	1259	0.486	0.750	0.6180	42.71845	42.71845	0.69025	-20.93444	20.93444
12	LBCA	171	1275	1.732	1.787	1.7595	3.12589	3.12589			
	LBCA	171	1276	1.786	1.683	1.7345	-5.93831	5.93831	1.74700	-1.43102	1.43102
13	ELTX	172	1303	0.416	0.431	0.4235	3.54191	3.54191			
	ELTX	172	1304	0.389	0.420	0.4045	7.66378	7.66378	0.41400	-4.58937	4.58937
14	RSCA	173	1335	1.102	1.123	1.1125	1.88764	1.88764			
	RSCA	173	1336	1.102	1.053	1.0775	-4.54756	4.54756	1.09500	-3.19635	3.19635
15	MNY	174	1357	1.010	1.016	1.0130	0.59230	0.59230			
	MNY	174	1358	1.140	1.129	1.1345	-0.96959	0.96959	1.07375	11.31548	11.31548
16	NWNJ	178	1376	0.636	0.598	0.6170	-6.15883	6.15883			
	NWNJ	178	1377	0.640	0.577	0.6085	-10.35333	10.35333	0.61275	-1.38719	1.38719
17	ELCA	179	1423	1.321	1.192	1.2565	-10.26661	10.26661			
	ELCA	179	1424	1.205	1.160	1.1825	-3.80550	3.80550	1.21950	-6.06806	6.06806
18	PLNJ	179	1450	0.235	0.242	0.2385	2.93501	2.93501			
	PLNJ	179	1451	0.287	0.284	0.2855	-1.05079	1.05079	0.26200	17.93893	17.93893
19	ALCA	181	1478	0.101	0.094	0.0975	-7.17949	7.17949			
	ALCA	181	1479	0.079	0.073	0.0760	-7.89474	7.89474	0.08675	-24.78386	24.78386
20	RLNC	186	1506	0.110	0.109	0.1095	-0.91324	0.91324			
	RLNC	186	1547	0.116	0.118	0.1170	1.70940	1.70940	0.11325	6.62252	6.62252
21	S4CA	186	1531	0.244	0.266	0.2550	8.62745	8.62745			
	S4CA	186	1532	0.273	0.261	0.2670	-4.49438	4.49438	0.26100	4.59770	4.59770

TABLE 4-22. (CONTINUED)

Sample No.	Site Code	Julian Date Sampled	Sample I.D. Number	Mean NMOC ppmC	Mean NMOC ppmC	Overall Mean	% Diff	Absolute % Diff	Sample Overall Mean	Duplicate % Diff.	Duplicate Abs. % Diff.
22	C3IL	186	1554	0.070	0.071	0.0705	1.41844	1.41844			
	C3IL	186	1555	0.058	0.068	0.0630	15.87302	15.87302	0.06675	-11.23596	11.23596
23	LXKY	188	1585	0.502	0.485	0.4935	-3.44478	3.44478			
	LXKY	188	1586	0.516	0.483	0.5005	-6.99301	6.99301	0.49700	1.40845	1.40845
24	GRMI	191	1603	0.213	0.209	0.2110	-1.89573	1.89573			
	GRMI	191	1604	0.243	0.226	0.2345	-7.24947	7.24947	0.22275	10.54994	10.54994
25	ELTX	194	1702	0.340	0.357	0.3485	4.87805	4.87805			
	ELTX	194	1703	0.348	0.374	0.3610	7.20222	7.20222	0.35475	3.52361	3.52361
26	ELCA	198	1750	0.219	0.222	0.2205	1.36504	7.20222			
	ELCA	198	1751	0.197	0.195	0.1960	-1.02041	1.02041	0.20825	-11.76471	11.76471
27	LBCA	200	1800	0.336	0.604	0.4700	57.02128	57.02128			
	LBCA	200	1801	0.597	0.629	0.6130	5.22023	5.22023	0.54150	26.40813	26.40813
28	ALCA	201	1817	0.771	0.773	0.7720	0.25907	0.25907			
	ALCA	201	1818	0.862	0.867	0.8645	0.57837	0.57837	0.81825	11.30461	11.30461
29	BACA	202	1851	1.090	1.081	1.0855	-0.82911	0.82911			
	BACA	202	1852	1.121	1.109	1.1150	-1.07623	1.07623	1.10025	2.68121	2.68121
30	DLTX	202	1887	0.316	0.320	0.3180	1.25786	1.25786			
	DLTX	202	1888	0.668	0.674	0.6710	0.89419	.89419	0.49450	71.38524	71.38524
31	S3CA	206	1909	0.186	0.203	0.1945	8.74036	8.74036			
	S3CA	206	1910	0.206	0.192	0.1990	-7.03518	7.03518	0.19675	2.28717	2.28717
32	S4CA	207	1929	0.190	0.180	0.1850	-5.40541	5.40541			
	S4CA	207	1930	0.195	0.180	0.1875	-8.00000	8.00000	0.18625	1.34228	1.34228
33	LXKY	208	1956	0.362	0.327	0.3445	-10.15965	10.15965			
	LXKY	208	1957	0.361	0.338	0.3495	-6.58083	6.58083	0.34700	1.44092	1.44092
34	FECA	209	1985	0.396	0.428	0.4120	7.76699	7.76699			
	FECA	209	1986	0.343	0.439	0.3910	24.55243	24.55243	0.40150	-5.23039	5.23039
35	S4CA	212	1989	0.101	0.109	0.1050	7.61905	7.61905			
	S4CA	212	1990	0.092	0.092	0.0920	0.00000	0.00000	0.09850	-13.19797	13.19797
36	C3IL	213	2018	0.138	0.141	0.1395	2.15054	2.15054			
	C3IL	213	2019	0.142	0.131	0.1365	-8.05861	8.05861	0.13800	-2.17391	2.17391
37	MNY	214	2062	0.710	0.725	0.7175	2.09059	2.09059			
	MNY	214	2063	0.715	0.659	0.6870	-8.15138	8.15138	0.70225	-4.34318	4.34318
38	DLTX	215	2115	0.114	0.121	0.1175	5.95745	5.95745			
	DLTX	215	2116	0.116	0.109	0.1125	-6.22222	6.22222	0.11500	-4.34783	4.34783
39	BMTX	216	2089	0.966	0.944	0.9550	-2.30366	2.30366			
	BMTX	216	2090	0.965	0.971	0.9680	0.61983	0.61983	0.96150	1.35205	1.35205
40	FECA	219	2128	0.592	0.455	0.5235	-26.17001	26.17001			
	FECA	219	2129	0.441	0.433	0.4370	-1.83066	1.83066	0.48025	-18.01145	18.01145
41	S2MO	220	2149	0.470	0.461	0.4655	-1.93340	1.93340			
	S2MO	220	2150	0.508	0.510	0.5090	0.39293	0.39293	0.48725	8.92766	8.92766
42	ALCA	221	2177	0.158	0.131	0.1445	-18.68512	18.68512			
	ALCA	221	2178	0.155	0.152	0.1535	-1.95440	1.95440	0.14900	6.04027	6.04027

TABLE 4-22. (CONTINUED)

Sample No.	Site Code	Julian Date Sampled	Sample I.D. Number	Mean NMOC ppmC	Mean NMOC ppmC	Overall Mean	% Diff	Absolute % Diff	Sample Overall Mean	Duplicate % Diff.	Duplicate Abs. % Diff.
43	BACA	222	2194	0.670	0.704	0.6870	4.94905	4.94905			
	BACA	222	2195	0.723	0.712	0.7175	-1.53310	1.53310	0.70225	4.34318	4.34318
44	ELCA	223	2225	0.370	0.386	0.3780	4.23280	4.23280			
	ELCA	223	2226	0.376	0.369	0.3725	-1.87919	1.87919	0.37525	-1.46569	1.46569
45	S4CA	226	2261	0.571	0.550	0.5605	-3.74665	3.74665			
	S4CA	226	2262	0.552	0.500	0.5260	-9.88593	9.88593	0.54325	-6.35067	6.35067
46	BMTX	227	2280	0.831	0.779	0.8050	-6.45963	6.45963			
	BMTX	227	2281	0.863	0.868	0.8655	0.57770	0.57770	0.83525	7.24334	7.24334
47	LXKY	227	2312	1.771	1.806	1.7885	1.95695	1.95695			
	LXKY	227	2313	1.796	1.800	1.7980	0.22247	0.22247	1.79325	0.52976	0.52976
48	S3CA	229	2346	0.103	0.076	0.0895	-30.16760	30.16760			
	S3CA	229	2347	0.105	0.114	0.1095	8.21918	8.21918	0.09950	20.10050	20.10050
49	LBCA	230	2360	0.394	0.433	0.4135	9.43168	9.43168			
	LBCA	230	2361	0.475	0.433	0.4540	-9.25110	9.25110	0.43375	9.33718	9.33718
50	S2MO	233	2372	0.412	0.443	0.4275	7.25146	7.25146			
	S2MO	233	2373	0.419	0.454	0.4365	8.01833	8.01833	0.43200	2.08333	2.08333
51	GRMI	234	2397	0.520	0.531	0.5255	2.09324	2.09324			
	GRMI	234	2398	0.532	0.607	0.5695	13.16945	13.16945	0.54750	8.03653	8.03653
52	S3CA	235	2438	0.163	0.161	0.1620	-1.23457	1.23457			
	S3CA	235	2439	0.163	0.174	0.1685	6.52819	6.52819	0.16525	3.93343	3.93343
53	ELTX	236	2444	0.357	0.331	0.3440	-7.55814	7.55814			
	ELTX	236	2445	0.358	0.368	0.3630	2.75482	2.75482	0.35350	5.37482	5.37482
54	LBCA	240	2482	0.741	0.799	0.7700	7.53247	7.53247			
	LBCA	241	2483	0.747	0.796	0.7715	6.35126	6.35126	0.77075	0.19462	0.19462
55	ELCA	241	2515	0.595	0.603	0.5990	1.33556	1.33556			
	ELCA	241	2516	0.595	0.610	0.6025	2.48963	2.48963	0.60075	0.58261	0.58261
56	S4CA	243	2577	0.364	0.322	0.3430	-12.24490	12.24490			
	S4CA	243	2578	0.199	0.358	0.2785	57.09156	57.09156	0.31075	-20.75623	20.75623
57	FECA	244	2617	0.727	0.743	0.7350	2.17687	2.17687			
	FECA	244	2618	0.672	0.749	0.7105	10.83744	10.83744	0.72275	-3.38983	3.38983
58	ELTX	248	2642	0.403	0.405	0.4040	0.49505	0.49505			
	ELTX	248	2643	0.464	0.441	0.4525	-5.08287	5.08287	0.42825	11.32516	11.32516
59	H1TX	250	2646	1.303	1.340	1.3215	2.79985	2.79985			
	H1TX	250	2647	1.357	1.320	1.3385	-2.76429	2.76429	1.33000	1.27820	1.27820
60	S2MO	250	2682	0.546	0.528	0.5370	-3.35196	3.35196			
	S2MO	250	2683	0.524	0.525	0.5245	0.19066	0.19066	0.53075	-2.35516	2.35516
61	GRMI	254	2707	0.462	0.431	0.4465	-6.94289	6.94289			
	GRMI	254	2708	0.405	0.476	0.4405	16.11805	16.11805	0.44350	-1.35287	1.35287
62	MGAL	254	2736	0.185	0.164	0.1745	-12.03438	12.03438			
	MGAL	254	2737	0.195	0.163	0.1790	-17.87709	17.87709	0.17675	2.54597	2.54597
63	LXKY	255	2783	0.194	0.201	0.1975	3.54430	3.54430			
	LXKY	255	2784	0.184	0.177	0.1805	-3.87812	3.87812	0.18900	-8.99471	8.99471

TABLE 4-22. (CONTINUED)

Sample No.	Site Code	Julian Date Sampled	Sample I.D. Number	Mean NMOC ppmC	Mean NMOC ppmC	Overall Mean	% Diff	Absolute % Diff	Sample Overall Mean	Duplicate % Diff.	Duplicate Abs. % Diff.
64	RLNC	256	2758	0.083	0.092	0.0875	10.2[illegible]	10.28571			
	RLNC	256	2759	0.098	0.101	0.0995	3.01508	3.01508	0.09350	12.83422	12.83422
65	S4CA	258	2838	0.313	0.139	0.2260	-76.99115	76.99115			
	S4CA	258	2839	0.306	0.307	0.3065	0.32626	0.32626	0.26625	30.23474	30.23474
66	MNY	261	2863	0.322	0.321	0.3215	-0.31104	0.31104			
	MNY	261	2864	0.273	0.288	0.2805	5.34759	5.34759	0.30100	-13.62126	13.62126
67	LBCA	263	2879	1.945	1.961	1.9530	0.81925	0.81925			
	LBCA	263	2880	1.961	1.961	1.9610	0.00000	0.00000	1.95700	0.40879	0.40879
68	ELCA	263	2938	0.538	0.572	0.5550	6.12613	6.12613			
	ELCA	263	2939	0.531	0.566	0.5485	6.38104	6.38104	0.55175	-1.17807	1.17807
69	MGAL	265	2953	0.268	0.286	0.2770	6.49819	6.49819			
	MGAL	265	2954	0.271	0.263	0.2670	-2.99625	2.99625	0.27200	-3.67647	3.67647
70	LXKY	268	2977	0.298	0.297	0.2975	-0.33613	0.33613			
	LXKY	268	2978	0.308	0.313	0.3105	1.61031	1.61031	0.30400	4.27632	4.27632
71	S2MO	269	3003	0.367	0.352	0.3595	-4.17246	4.17246			
	S2MO	269	3004	0.367	0.373	0.3700	1.62162	1.62162	0.36475	2.87868	2.87868
72	ELCA	270	3024	0.427	0.251	0.3390	-51.91740	51.91740			
	ELCA	270	3025	0.427	0.241	0.3340	-55.68862	55.68862	0.33650	-1.48588	1.48588
73	C3IL	272	3048	0.190	0.214	0.2020	11.88119	11.88119			
	C3IL	272	3049	0.209	0.163	0.1860	-24.73118	24.73118	0.19400	-8.24742	8.24742
74	RSCA	272	3089	1.420	1.450	1.4350	2.09059	2.09059			
	RSCA	272	3090	1.407	1.504	1.4555	6.66438	6.66438	1.44525	1.41844	1.41844
75	PLNJ	272	3110	0.542	0.546	0.5440	0.73529	0.73529			
	PLNJ	272	3111	0.557	0.557	0.5570	0.00000	0.00000	0.55050	2.36149	2.36149
			Overall Average			0.5019	0.34232	8.24108	0.50189	1.29576	8.01005

TABLE 4-23. ANOVA FOR DUPLICATE - REPLICATE SETS.

Source	Sum-of-Squares	DF	Mean-Square	F-Ratio	P
Replicate Set No. 1					
S_i	0.678345E+02	49	1.384377820	0.505878E+03	0.000000000
$D_{j(i)}$	0.012204354	1	0.012204354	4.459702798	0.035362692
$R_{k(i)}$	0.002064966	1	0.002064966	0.754577701	0.385584881
$e_{l(ijk)}$	1.028955822	376	0.002736585		
Replicate Set No. 2					
S_i	0.710466E+02	50	1.420932589	0.655102E+03	0.000000000
$D_{j(i)}$	0.026215439	1	0.026215439	0.120863E+02	0.000566336
$R_{k(i)}$	0.002803749	1	0.002803749	1.292630981	0.256276338
$e_{l(ijk)}$	0.828567488	382	0.02169025		

TABLE 4-24. EXPECTED MEAN SQUARES FOR NESTED EXPERIMENT

Model	EMS
S_i	$\sigma_e^2 + 2.147\ \sigma_R^2 + 4.293\ \sigma_D^2 + 107.35\ \sigma_S^2$
$D_{j(i)}$	$\sigma_e^2 + 2.147\ \sigma_R^2 + 4.293\ \sigma_D^2$
$R_{k(ij)}$	$\sigma_e^2 + 2.147\ \sigma_R^2$
$e_{l(ijk)}$	σ_e^2

mean-square is the between-replicate term and contains both analyical error and the error associated with removing the sample from the canister. The duplicate mean-square contains both analytical error, the error in removing the sample from the canister, and the error between duplicate samples. The ambient sample mean-square term contains all the previous errors and the effect of different sites and sampling days from sample to sample.

The data set was divided into two overlapping sets of 50 (50 in Replicate Set No. 1 and 51 in Replicate Set No. 2) each. This was done because running the entire data set resulted in a matrix that was not solvable in SYSTAT®. The ANOVA tables for the two sets are given in Tables 4-23 and 4-24. Probabilities less than 0.05 are taken to be significant. Therefore, in both data sets, $D_{j(i)}$ and S_i are significant. The latter, or the ambient sample term, was expected to be significant. The duplicate term was significant, which implies that the sample within the canister on the average has a significantly different concentration upon analysis.

On the other hand, the replicate effect, $R_{k(ij)}$, was not significant in either data set. Table 4-24 reflects the fact that there were, on the average, two replicates, two duplicates, and 75 ambient air samples. There were a total of 644 injections, or 2.147 injections per ambient air sampler per duplicate per replicate. From the ANOVA tables it was concluded that the replicate mean-square was not significantly different from zero.

The variance of the analytical precision is σ_e^2, which may be pooled between replicate sets in Table 4-23 to give 0.002450558. The duplicate variance is calculated from a pooled value of mean-square for duplicates equal to 0.019209897.

$$0.019209897 = \sigma_e^2 + 4.293\ \sigma_D^2$$

$$\sigma_D^2 = (0.019209897 - 0.002450558) / 4.293$$

$$\sigma_D^2 = 0.003903876$$

Therefore, a standard deviation for analysis is equal to:

$$s_e = \sqrt{\sigma^2} = \sqrt{0.002450558} = 0.0495.$$

The standard deviation for duplicates is equal to:

$$s_D = \sqrt{\sigma_D^2} = \sqrt{0.003903876} = 0.0625,$$

or about 25% higher.

The fact that the duplicate effect is significant means that, on the average, there is a difference in the concentration between duplicates that is greater than can be attributed to analytical error. This means that on the average there is a significant difference between the concentration of the samples in the duplicate canisters when they are analyzed.

A possible explanation for this phenomenon is that carryover of adsorbed organic material is different between duplicate canisters. In order to test this hypothesis further, it is recommended that: (1) during the 1990 NMOC Monitoring Program a record be kept of the NMOC concentration in a duplicate canister before cleanup, and the zero-air NMOC concentration at the time of the third pressurization with clean humidified air during cleanup; and (2) the duplicate sample schedule be so arranged that the same amount of time elapses between sampling and analysis for all duplicate samples. The latter specification may require that duplicate samples, for which replicate analyses are performed, will be taken only on Mondays and Tuesdays so that the time between the first and second replicate analyses is 24 hours.

4.5.2 Quality Control Chart

The duplicate quality control chart showing the 2-σ warning limits and the 3-σ control limits is shown in Figure 4-31. The chart was updated daily in order to monitor whether the NMOC program sampling and analytical systems were in control. From 1989 Julian date 240 through about 265 the control chart shows a number of excursions outside either the warning limits ($\mu \pm 2\sigma$) or the control limits ($\mu \pm 3\sigma$). There was, however, no indication (more than two successive points outside either the warning limits or the control limits) of loss of control. It is necessary to keep in mind that although the analytical systems were centrally located, the sampling systems, which contributed significantly to the overall system variability, were located at 45 sites across the country.

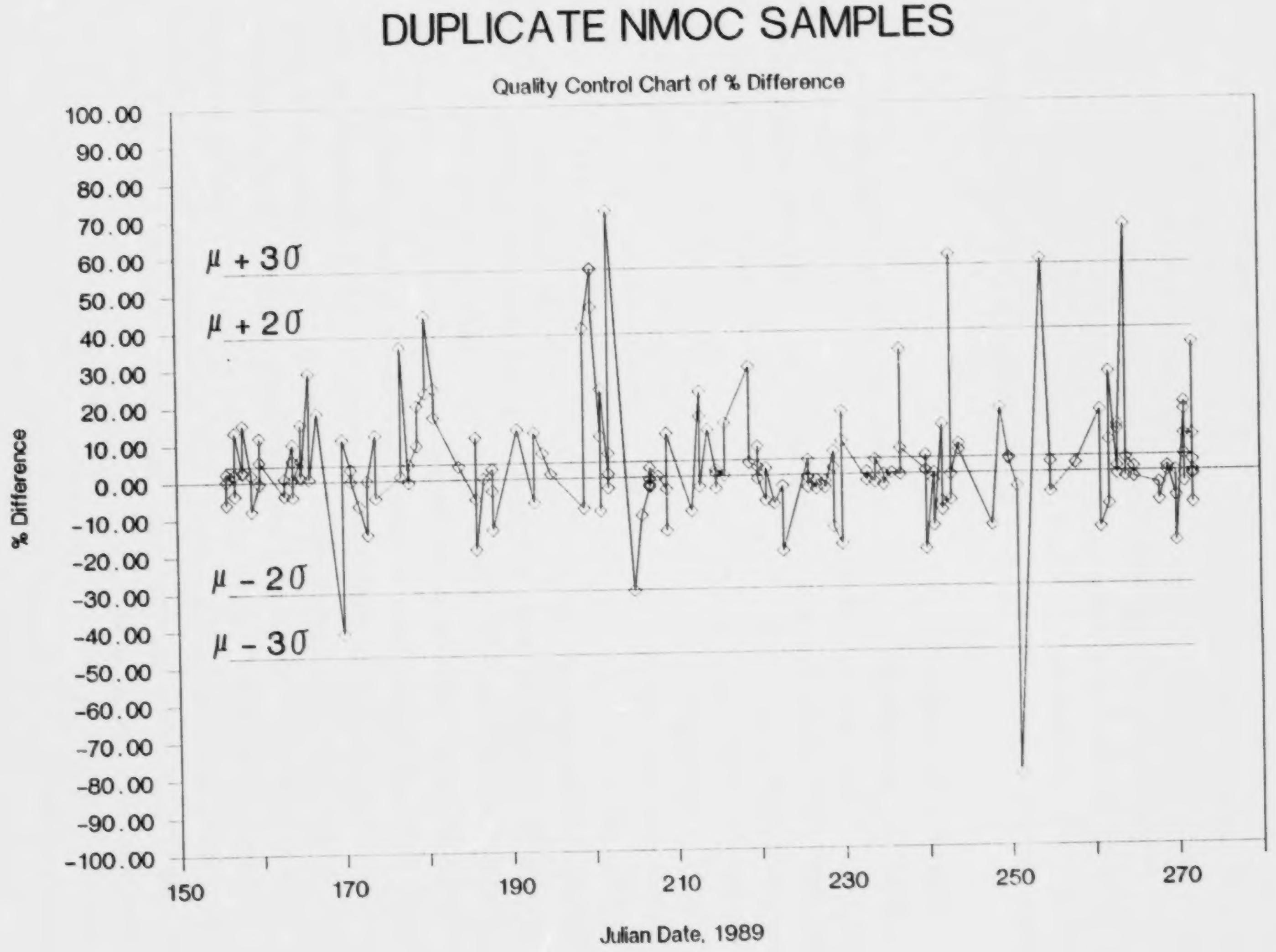

Figure 4-31. Quality control chart of percent difference for duplicate NMOC analyses.

4.5.3 Precision Profile

As in the case of replicate analyses, the data show that at lower NMOC concentrations, percent difference between duplicate analyses increases. Figure 4-32 shows percent difference plotted against average NMOC concentration. Table 4-25 summarizes the duplicate imprecision into eleven data sets summarized by average NMOC concentrations ranging from 0.050 to 2.25. Average percent difference and average absolute percent difference from Table 4-25 are plotted in Figures 4-33 and 4-34, respectively. The trend of increasing imprecision at NMOC concentration levels below 1.0 ppmC is clear.

4.6 CANISTER PRESSURE RESULTS

Canister pressure results for the NMOC Monitoring Program are important to be sure that the ambient air samples obtained are representative. The NMOC sampling systems are designed to obtain an integrated ambient air sample between 6:00 a.m. and 9:00 a.m., or at other programmed intervals. The flow rate of the sample into the 6-L canister is controlled by a critical orifice, which requires a pressure drop across the orifice sufficiently high to maintain sonic velocity in the orifice. If sonic velocity can be maintained in the orifice for the entire sampling period, then the flow rate into the canister is constant and the sample is properly integrated. The temperature must also be assumed to remain constant over the sampling period.

As the final canister pressure increases, there is a pressure downstream of the sonic orifice at which the sonic velocity can no longer be maintained. Canister pressures are being measured to obtain a better understanding of the range and magnitude of pressures being generated by the NMOC sampling systems. Canister pressure data are given in Tables 4-26 and 4-27 for both single canister samples and duplicate samples. The pressures reported in Tables 4-26 and 4-27 are the canister sampling pressures measured immediately before analysis in the laboratory. A significant decrease between the field sampling pressure and the laboratory value might indicate a leak. The canister was leak tested when this occurred.

Table 4-26 gives statistics for single and duplicate samples. All sample canisters averaged 14.9 psig, while duplicate samples averaged

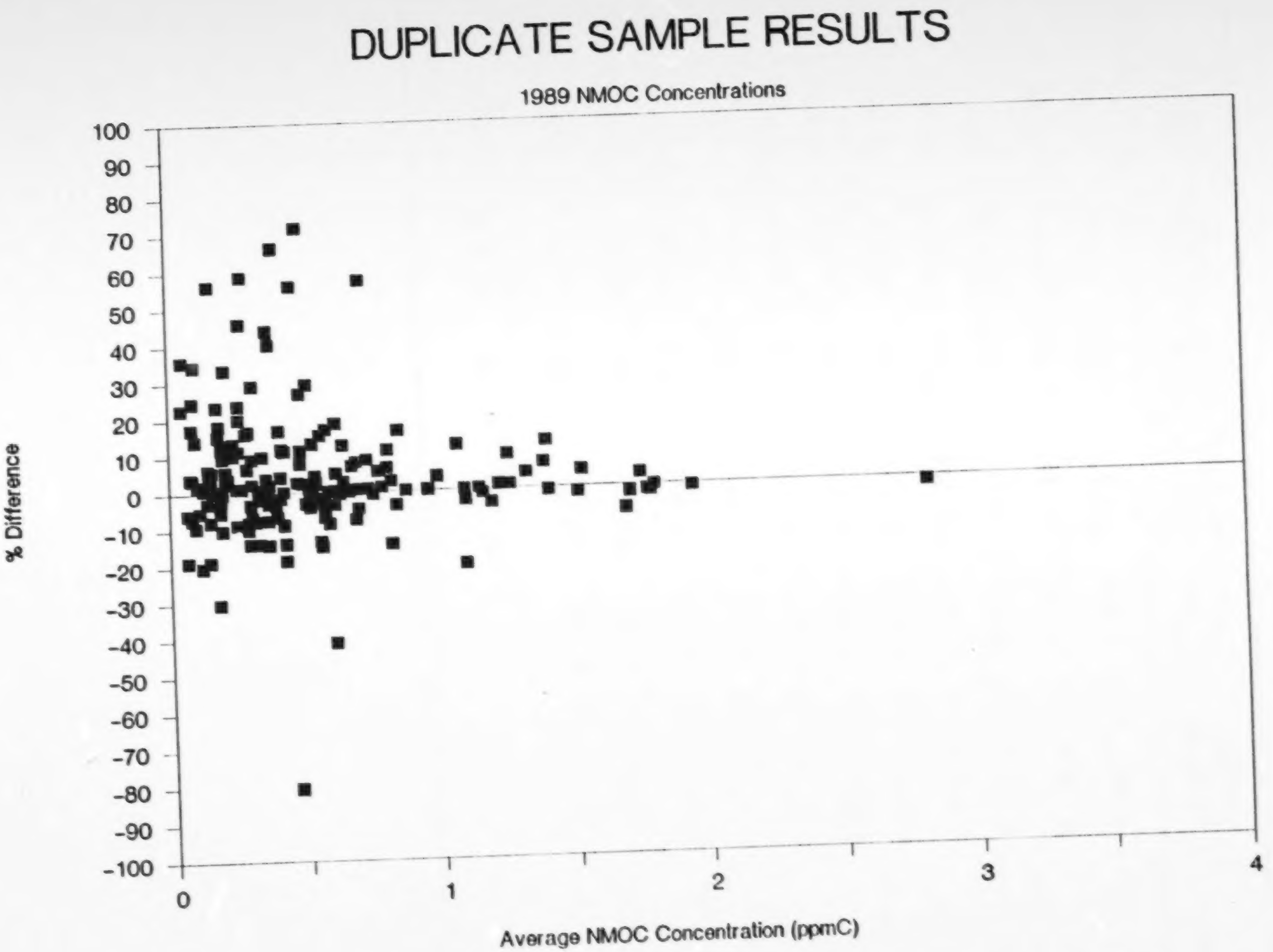

Figure 4-32. Duplicate NMOC sample results comparing average concentrations with percent difference.

TABLE 4-25. 1989 NMOC DUPLICATE IMPRECISION

Cases	NMOC Range	NMOC ppmC	Minimum % Diff.	Average % Diff.	Absolute % Diff.	Maximum %Diff.
12	0.000-0.099	0.050	-18.750	9.553	16.432	35.714
25	0.100-0.199	0.150	-30.471	1.521	10.167	56.151
22	0.200-0.299	0.250	-9.881	12.611	15.042	58.615
25	0.300-0.399	0.350	-14.344	2.512	8.765	43.968
19	0.400-0.499	0.450	-80.514	8.281	22.018	71.545
24	0.500-0.599	0.550	-14.925	0.714	6.662	29.235
12	0.600-0.699	0.650	-41.176	-0.579	8.274	18.474
9	0.700-0.799	0.750	-4.664	8.430	9.641	57.163
8	0.800-0.999	0.900	-14.475	2.281	6.844	16.336
15	1.000-0.499	1.250	-20.271	1.445	5.281	12.442
10	1.500-3.000	2.250	-6.459	-0.796	2.282	4.361
Overall			-80.514	4.179	10.128	71.545

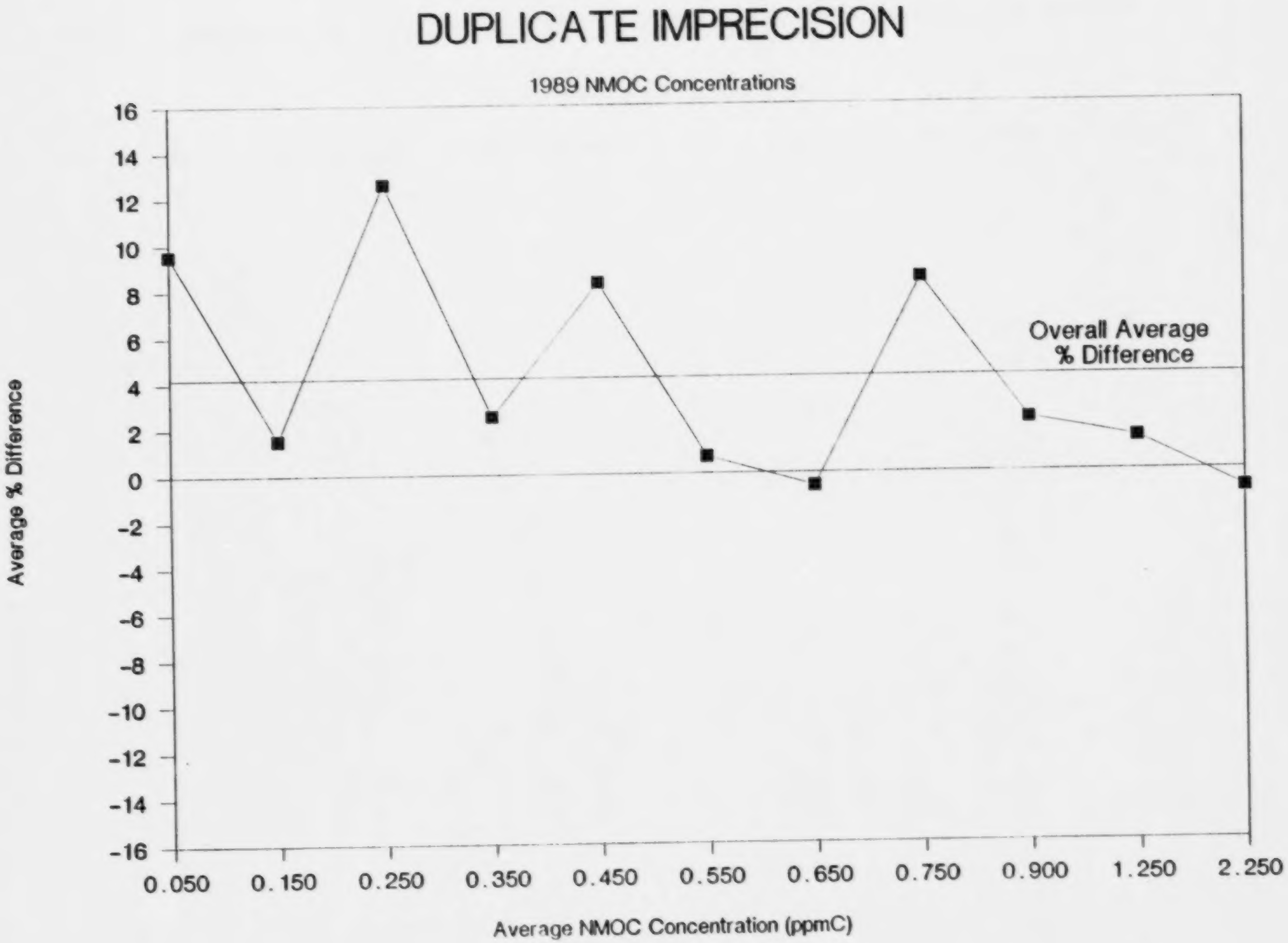

Figure 4-33. Duplicate NMOC sample results comparing average concentration with average percent difference.

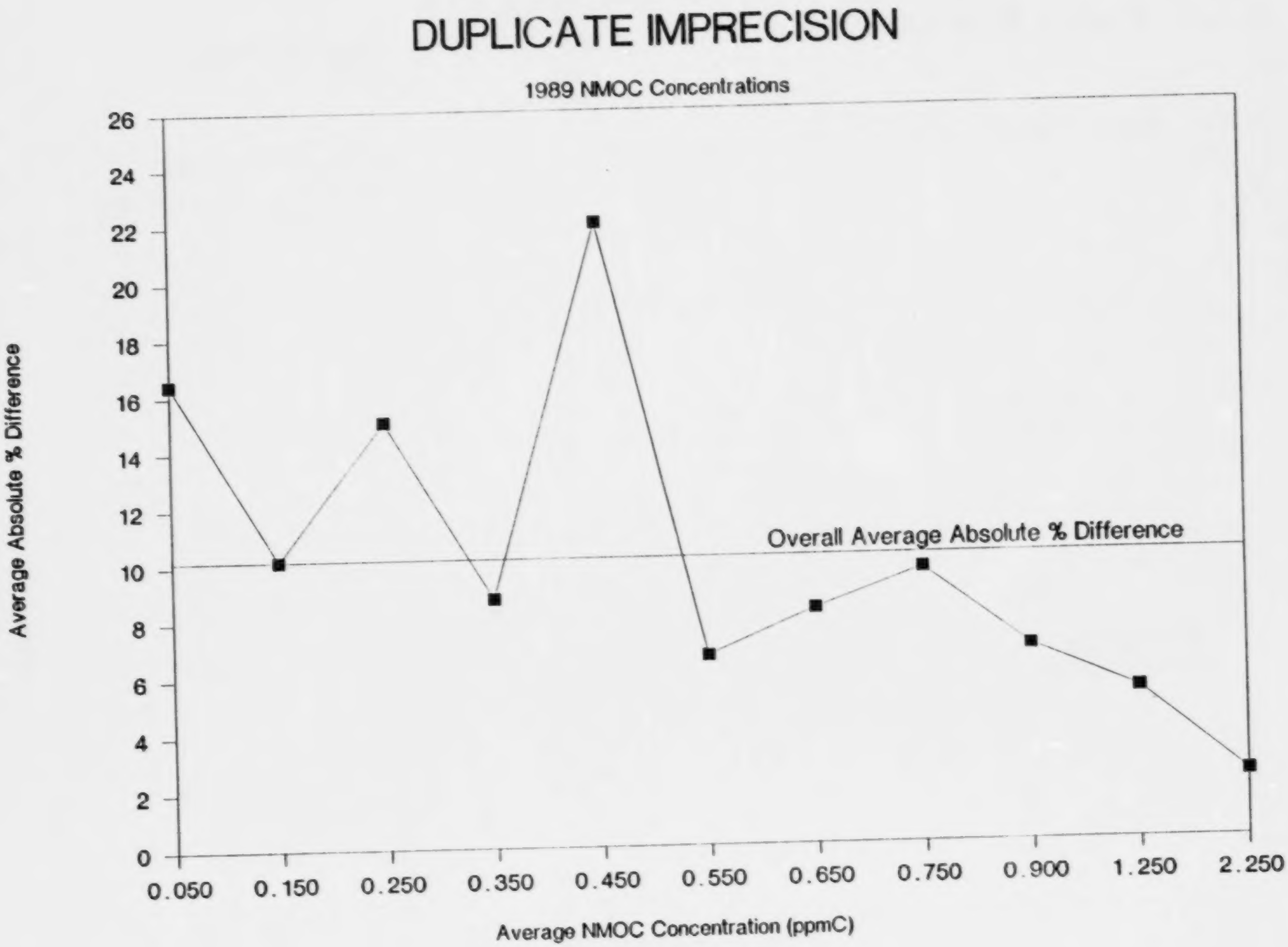

Figure 4-34. Duplicate NMOC sample results comparing average concentration with average absolute percent difference.

TABLE 4-26. NMOC PRESSURE STATISTICS

Statistics	All Samples	Duplicate Sample Canisters
Number of Cases	1956	388
Minimum Pressure, psig	5.0	6.0
Maximum Pressure, psig	29.0	29.0
Mean Pressure, psig	14.867	16.846
Median Pressure, psig	15.0	16.0
Standard Deviation, psig	3.031	3.450
Skewness	0.398	0.749
Kurtosis	1.714	2.020

TABLE 4-27. PRESSURE DISTRIBUTION OF NMOC AMBIENT AIR SAMPLES

Pressure Range, psig	Single Sample Cases	Duplicate Sample Canister Cases
Blank[a]	1	1
4.0 to 4.9	0	0
5.0 to 5.9	1	0
6.0 to 6.9	7	1
7.0 to 7.9	2	0
8.0 to 8.9	20	4
9.0 to 9.9	22	1
10.0 to 10.9	116	4
11.0 to 11.9	73	2
12.0 to 12.9	158	13
13.0 to 13.9	148	21
14.0 to 14.9	338	36
15.0 to 15.9	235	40
16.0 to 16.9	340	72
17.0 to 17.9	170	45
18.0 to 18.9	165	64
19.0 to 19.9	55	26
20.0 to 20.9	50	19
21.0 to 21.9	8	4
22.0 to 22.9	21	11
23.0 to 23.9	2	2
24.0 to 24.9	12	10
25.0 to 25.9	0	0
26.0 to 26.9	2	2
27.0 to 27.9	2	2
28.0 to 28.9	7	7
29.0 to 29.9	1	1
TOTAL	1956	388[b]

[a] Blank indicates no pressure reading given for sample.
[b] Equals 194 duplicate samples.

16.8 psig. The column entitled "All Samples" includes pressures from both single samples and duplicate samples. Standard deviations were 3.031 and 3.450 psig, respectively. The data show little skewness, so the distribution is approximately symetrical.

4.7 CANISTER CLEANUP RESULTS

Prior to the start of the 1989 NMOC Sampling and Analysis Program all of the canisters were cleaned and analyzed for their NMOC content to establish canister initial conditions. The resulting analysis with cleaned, dried air that had been humidified averaged 5.5 area counts (0.0017 ppmC), ranging from zero to 66.69 area counts (0.021 ppmC). Any canisters that produced more than 0.025 ppmC were recleaned.

Continual monitoring of the cleanup was important to ensure that there was negligible carryover from one site sample to the next. The daily canister cleanup procedure is described in detail in Section 3.4. The NMOC content was below 0.030 ppmC and cleanup was considered to be satisfactory.

Percent recoveries, or percent cleanup, in 1989 averaged 99.742%, (99.689% in 1988, 99.374% in 1987, 99.891% in 1986, and 99.898% in 1985), ranging from 92.12% to 100 percent. The reported percent cleanup figures should be considered minimum values. The actual percent cleanup was greater than the reported values because, after the percent cleanup was measured, the canister was evacuated a third time before being shipped to the site.

4.8 EXTERNAL AUDIT RESULTS

Primary measures of accuracy were calculated from the results of the analysis of audit samples provided by EPA-QAD. Results are reported in terms of percent bias, relative to the EPA standards.

Audit samples of propane provided by EPA-QAD were referenced to NBS SRM propane No. 1668B. Each Radian channel and the EPA-AREAL channel analyzed each audit sample. The results of these analyses are given in Table 4-28. Audit sample bias, percent bias, and absolute percent bias are shown in Table 4-29. In Table 4-29, all bias measurements are relative to the QAD results. Overall Radian average bias was 0.84%, indicating Radian channels averaged 0.84% lower than the EPA-QAD reference values. Radian mean bias ranged from 0.38% for Channel B to 1.29% for Channel C. The overall average

TABLE 4-28. 1989 NMOC AUDIT SAMPLE RESULTS

Analyzed			Channel					
Date	Julian Date	Radian ID Number	A NMOC ppmC	B NMOC ppmC	C NMOC ppmC	D NMOC ppmC	QAD NMOC ppmC	AREAL NMOC ppmC
06/05/89	156	1005	1.154	1.141	1.142	1.142	1.154	--
06/05/89	156	1006	3.090	3.019	3.153	3.151	3.120	--
07/13/89	194	1647	0.563	0.575	0.566	0.560	0.545	--
07/13/89	194	1648	1.525	1.531	1.526	1.531	1.512	--
07/31/89	212	1969	0.740	0.758	0.727	0.719	0.724	--
08/17/89	229	2290	0.772	0.764	0.799	0.750	0.791	0.882
09/28/89	271	3020	0.592	0.578	0.577	0.560	0.582	0.560
09/28/89	271	3021	1.039	1.056	0.965	1.040	1.074	1.021

TABLE 4-29. AUDIT SAMPLES, RELATIVE TO EPA-QUALITY ASSURANCE DIVISION (QAD) RESULTS

	DELTAA ppmC	DELTAB ppmC	DELTAC ppmC	DELTAD ppmC	DELTAE ppmC	Chan. A Percent Bias	Chan. B Percent Bias	Chan. C Percent Bias	Chan. D Percent Bias	Chan. E Percent Bias	
	0.00000	-0.01300	-0.01200	-0.01200	-	0.00000	-1.12652	-1.03986	-1.03986	-	
	-0.03000	-0.10100	0.03300	0.03100	-	-0.96154	-3.23718	1.05769	0.99359	-	
	0.01800	0.03000	0.02100	0.01500	-	3.30275	5.50459	3.85321	2.75229	-	
	0.01300	0.01900	0.01400	0.01900	-	0.85979	1.25661	0.92593	1.25661	-	
	0.01600	0.03400	0.00300	-0.00500	-	2.20994	4.69613	0.41436	-0.69061	-	
	-0.01900	-0.02700	0.00800	-0.04100	-0.09050	-2.40202	-3.41340	1.01138	-5.18331	-11.44121	Radian
	0.01000	-0.00400	-0.00500	-0.02200	0.02250	1.71821	-0.68729	-0.85911	-3.78007	3.86598	Percent
	-0.03500	-0.01800	-0.10900	-0.03400	0.05300	-3.25885	-1.67598	-10.14898	-3.16574	4.93482	Bias
Average	-0.00338	-0.01000	-0.00588	-0.00613	-0.00500	0.18354	0.16462	-0.59817	-1.10714	-0.88014	-0.33929
Std. Dev.	0.02153	0.04319	0.04403	0.02601	0.07560	2.28437	3.38900	4.13999	2.75347	9.16176	3.21810

For Channel A:

DELTAA ppmC = NMOCA - QAD

Percent Bias = (DELTAA ppmC)/Q*100

Channel E is EPA-ASRL Channel

Absolute Values of Percent Bias

	0.00000	1.12652	1.03986	1.03986	-	
	0.96154	3.23718	1.05769	0.99359	-	
	3.30275	5.50459	3.85321	2.75229	-	
	0.85979	1.25661	0.92593	1.25661	-	
	2.20994	4.69613	0.41436	0.69061	-	Radian
	2.40202	3.41340	1.01138	5.18331	11.44121	Absolute
	1.71821	0.68729	0.85911	3.78007	3.86598	Percent
	3.25885	1.67598	10.14898	3.16574	4.93482	Bias
Average	1.83914	2.69971	2.41381	2.35776	6.74734	2.32761
Std. Dev.	1.17949	1.78512	3.29993	1.62150	4.09999	2.12701

absolute percent bias for the Radian channels was 2.33 percent. These accuracy measurements show excellent agreement with the reference values, and lend confidence to the 1989 NMOC concentration results determined on all the Radian channels.

The EPA-AREAL channel averaged -0.9% bias, relative to EPA-QAD. Figures 4-35, 4-36, 4-37, and 4-38 show the audit bias results for the Radian channels versus the reference values provided by EPA-QAD. Figure 4-39 shows the audit bias results for EPA-AREAL versus EPA-QAD.

4.9 DATA VALIDATION

The secondary backup disks were updated daily on 20 megabyte hard disks. At the completion of the sampling and analysis phase 26.4% of the data base was checked to verify its validity. Items checked included original data sheets, checks of all the calculations, and data transfers. In making the calculations for the final report and other reports, corrections were made to the data base as errors or omissions were encountered.

A total of 2,576 NMOC concentration measurements were performed by Radian in June through September 1989. For the regular 1989 NMOC Monitoring Program, there were 2,495 NMOC concentration measurements which included 1,965 sample analyses, 150 repeated analyses, 38 local ambient samples (x 4 analyses each), and 8 audit samples (x 4 analyses each). The remaining 81 analyses included analyses from the 1989 Raleigh diurnal study, the Maryland NMOC Monitoring Program, and the Portland Monitoring Program.

A percentage of the data base (14.6%, 373 cases out of 2,560 data points) was selected at random and validated according to the procedure outlined below.

A. Calibration factors were checked.

1. The area count from the strip chart that was used to determine the calibration factor was examined to verify that the data had been properly transferred to the calibration form.

2. The calibration form was examined to verify that the calculations had been correctly made.

3. Each datum on the disk was compared to the corresponding datum on the calibration sheet for accuracy.

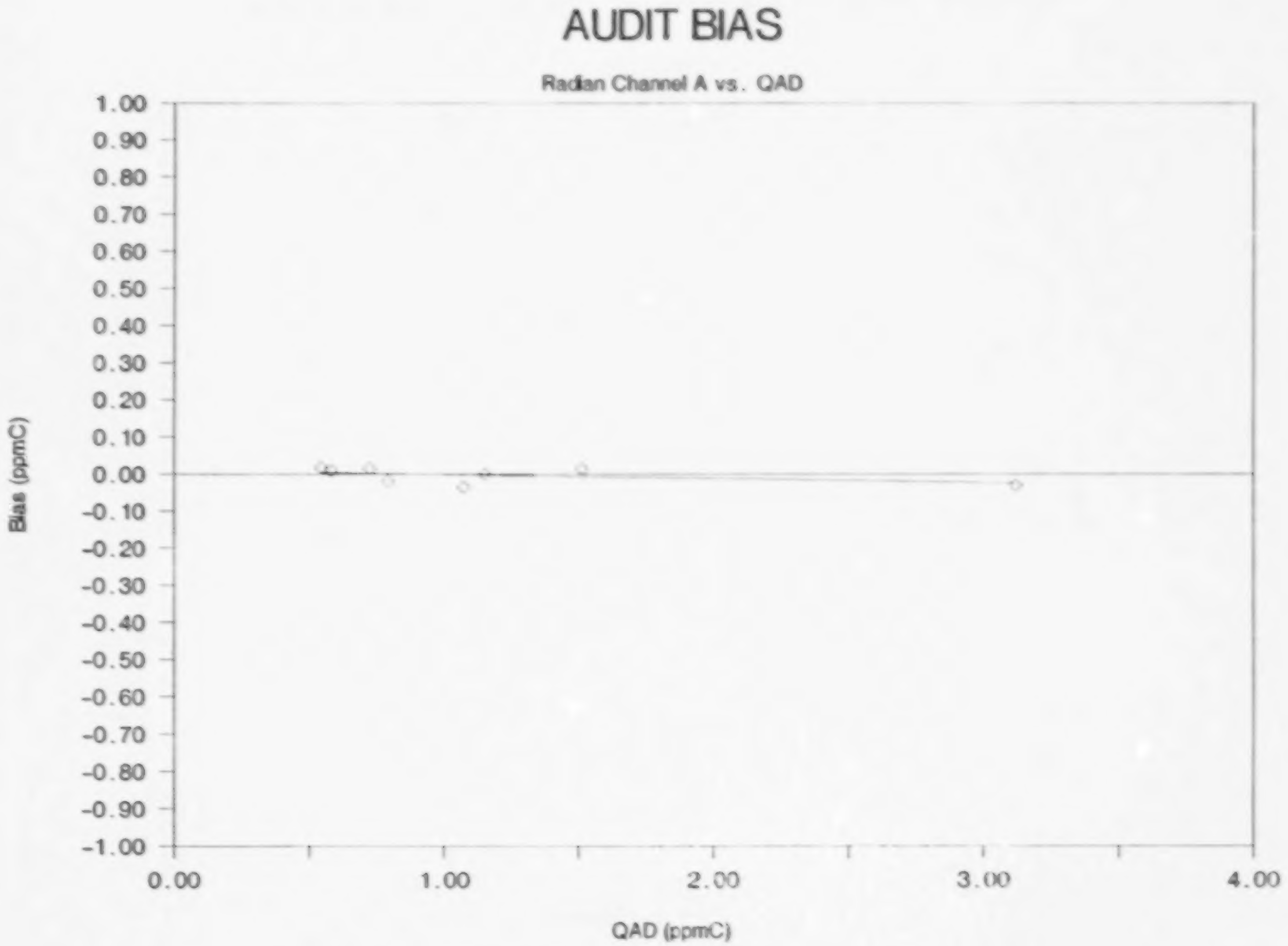

Figure 4-35. Audit Bias, Radian Channel A vs. EPA-QAD.

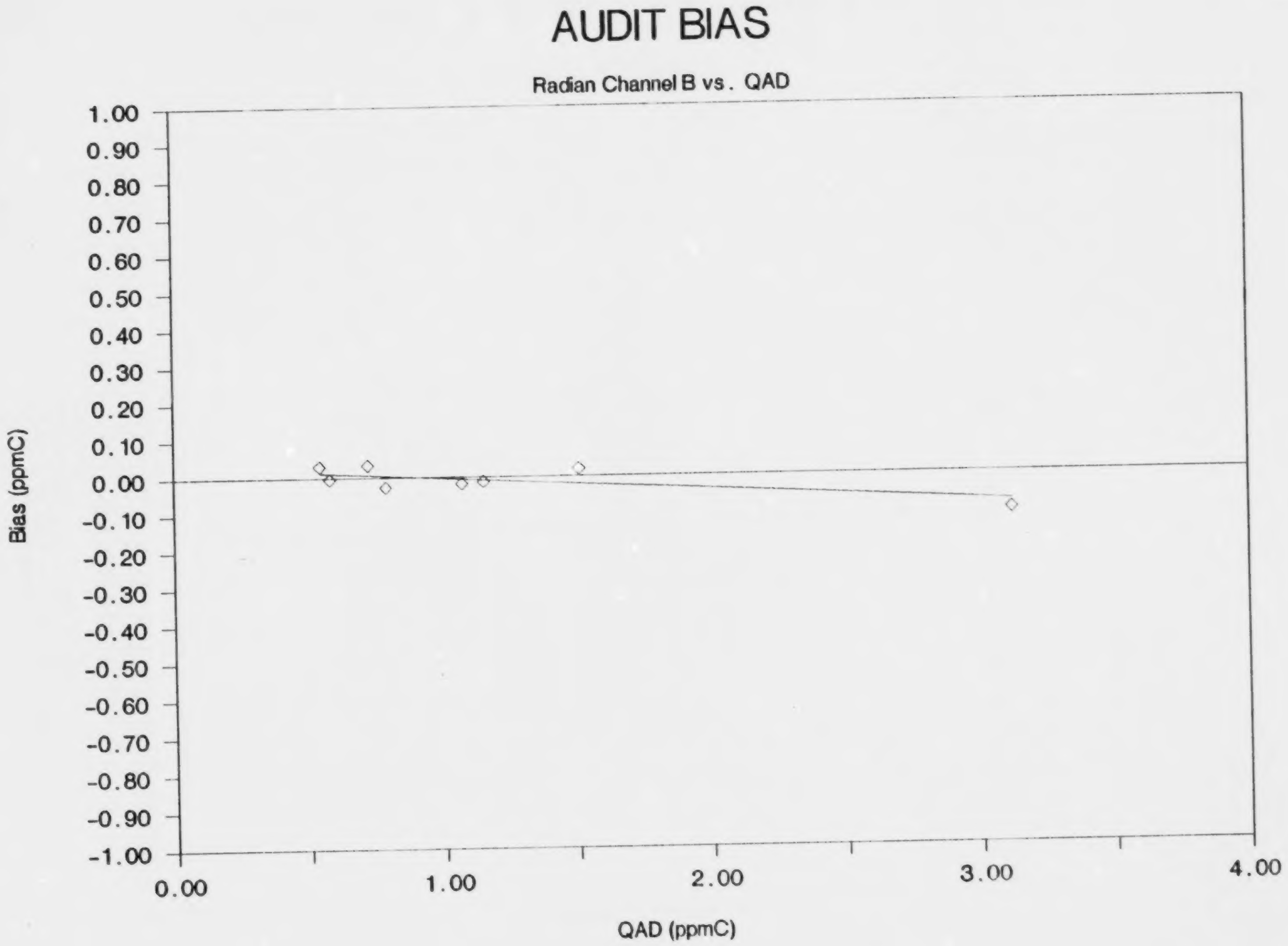

Figure 4-36. Audit Bias, Radian Channel B vs. EPA-QAD.

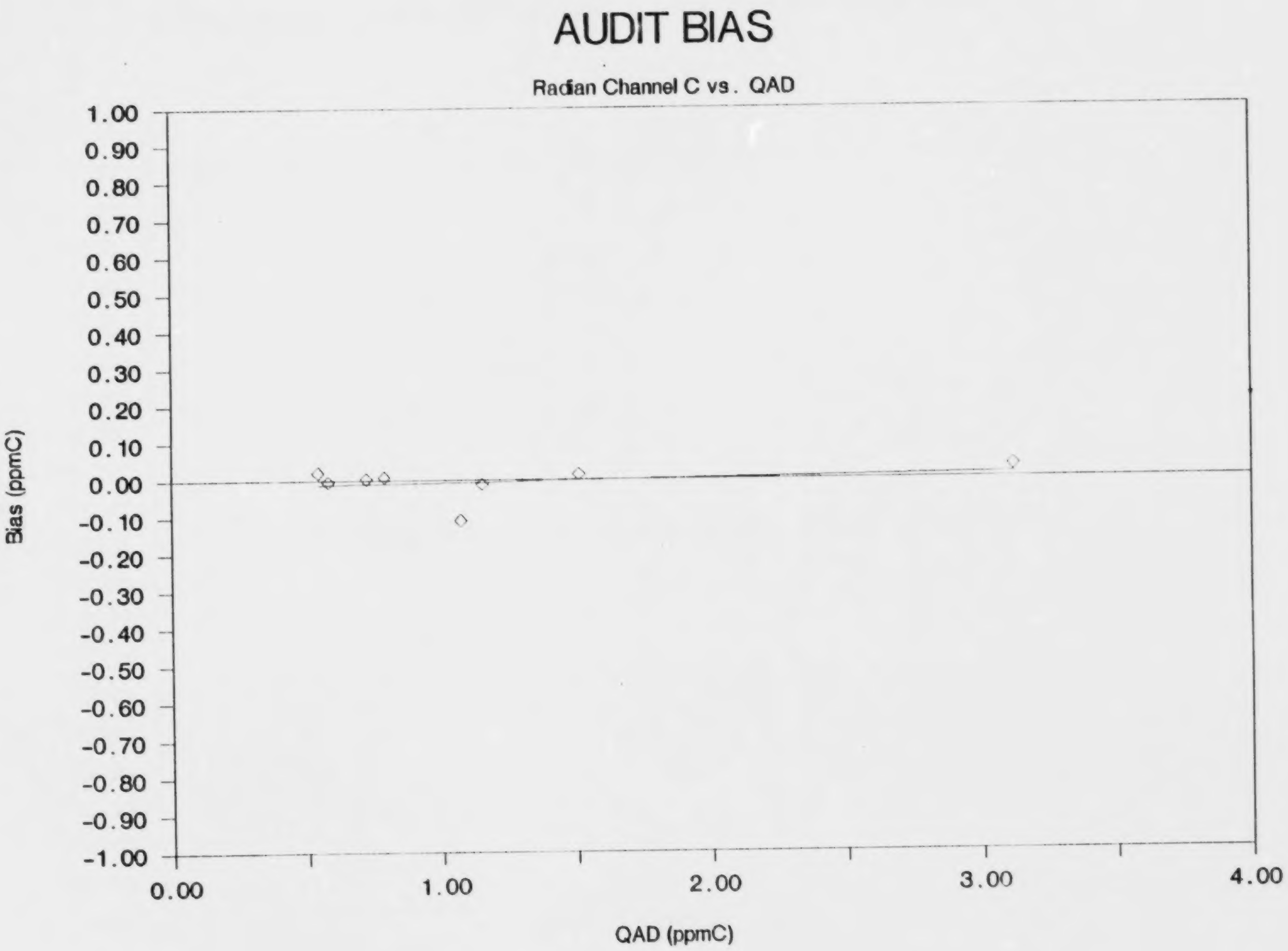

Figure 4-37. Audit Bias, Radian Channel C vs. EPA-QAD.

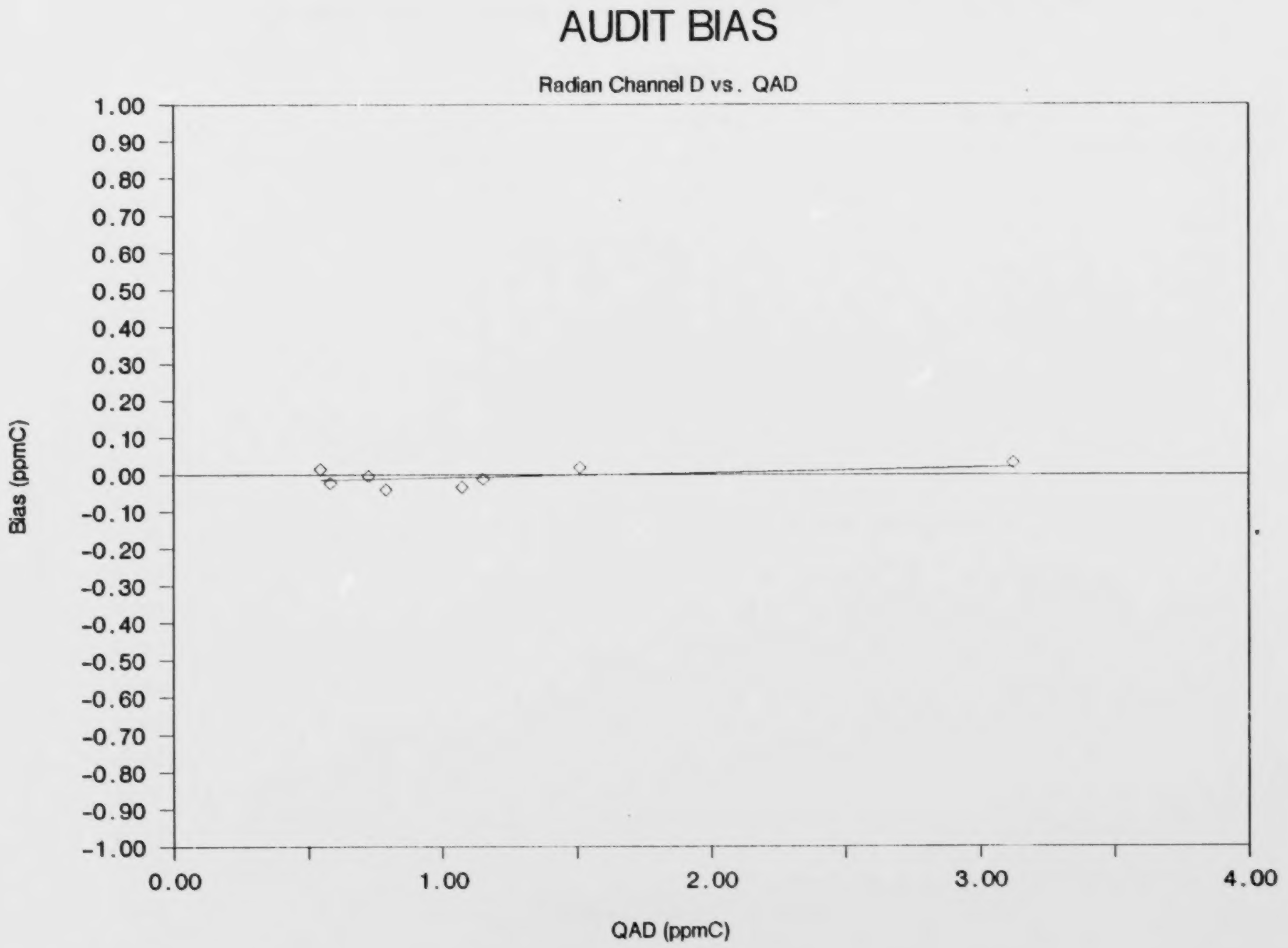

Figure 4-38. Audit Bias, Radian Channel D vs. EPA-QAD.

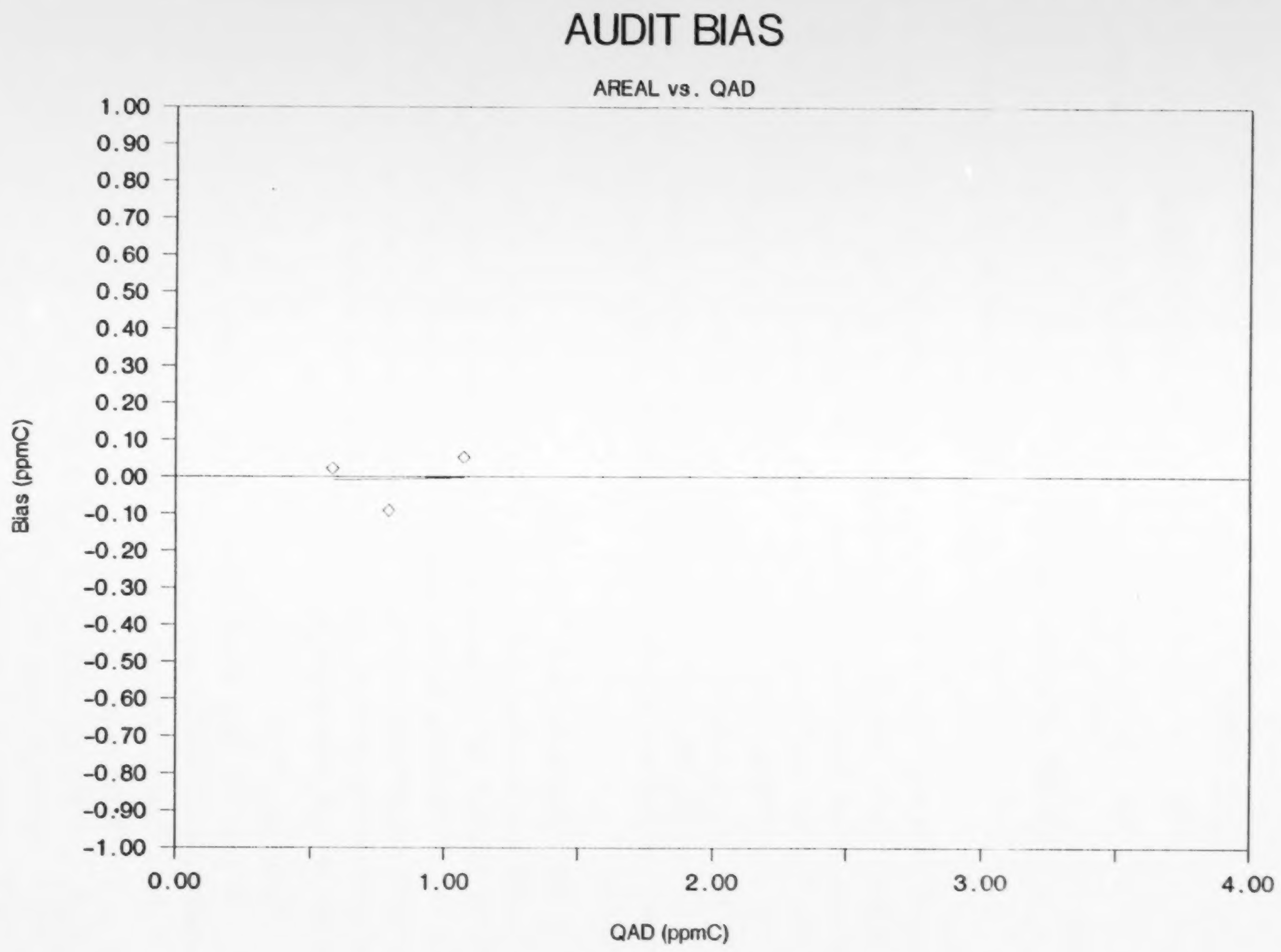

Figure 4-39. Audit Bias, EPA-AREAL vs. EPA-QAD.

B. Analysis data were checked.

1. Area counts were verified from the appropriate strip chart.
2. Calculations were reverified on the analysis forms.
3. Each datum on the disk was compared to the corresponding item on the analysis form.

C. Field data sheet was checked.

1. Each datum on the disk was compared to the corresponding datum on the field data sheet.

The error rate was calculated in terms of the number of items transferred from the original data sources. For each NMOC value in the 1989 data set, 36 items were transferred from original sources to the magnetic disks. In the data validation study each item on the disk was compared with the corresponding value on the original source of data. Seventy-nine errors were found (and corrected) for an expected error percentage of 0.369.

Each time the data file was opened and a suspected error found, the error was checked against the original archived documents, and corrected where appropriate.

4.10 NMOC MONITORING PROGRAM RECORDS

The quality assurance records developed by Radian for this project are extensive and will be preserved as archives. One of the most important objectives of the study was to develop a data base that is well planned and documented and contains NMOC data of known and verifiable quality. Achieving that objective has involved keeping and preserving a number of records that trace the project from planning through reporting.

4.10.1 Archives

In order to keep detailed records that document the quality of the measurements made, Radian developed the following original material:

- Quality Assurance Project Plan (QAPP);
- Notebooks;
- Field Data Sheets;
- Laboratory Calibration Sheets;
- Laboratory Analysis Sheets;

- Chromatographic Strip Charts;
- EPA-AREAL and EPA-QAD NMOC Results;
- Bi-weekly, Monthly Reports to EPA;
- Memoranda and Correspondence; and
- Final Report.

In addition to the above items, several papers to be presented at technical meetings and symposia and published in technical journals will be added to the archives.

The QAPP[2] was the Quality Assurance Project Plan and the workplan. The QAPP was designed according to the EPA Quality Assurance Guidelines, and set the pattern of steps necessary to document and control the quality of the data obtained throughout the study.

Several notebooks were necessary to maintain day-to-day records of the project. Field and laboratory data sheets were designed in advance, so that the data recorded appeared in a logical sequence and filled in blanks on the sheet. Additional space was provided for other comments. Each NMOC analysis was assigned a unique Radian Identification Number. Field data sheets and shipping records accompanied the canisters in transit.

4.10.2 Magnetic Disks

In order to manage the data base for report generation and data analysis, pertinent data from the various data sheets and notebooks were transferred to 20 megabyte magnetic disks. The following software was used in the construction of the data base: Paradox 3®, Lotus 1-2-3®, and PC File+®. Statistical calculations were done using SYSTAT® software. The data access is rapid and in a convenient form. The primary 20 megabyte magnetic disk has three backup disks.

5.0 NMOC DATA ANALYSIS AND CHARACTERIZATION

The purpose of this section is to characterize the NMOC data qualitatively as well as quantitatively. The NMOC data are shown to fit a two-parameter lognormal distribution better than a normal Gaussian distribution. The summary NMOC data for the sites of the 1989 study are given in Appendix E.

5.1 OVERALL CHARACTERIZATION

Figure 5-1 gives a stem-and-leaf plot of the 1989 Morning Site NMOC data along with statistics for NMOC. The stem-and-leaf plots show the actual NMOC concentrations truncated to two or three decimal points. The digits to the left of the vertical open space are called stems and the digits to the right of the open space are the leaves. The data are sorted from the smallest at the top of the graph to the largest at the bottom of the graph. The minimum NMOC value measured was 0.043 ppmC and is shown as "0   4" on the first row at the top of the plot. The maximum NMOC concentration measured was 5.013, shown as "50   1" in the bottom row of the chart. The plot shows 1,784 leaves, one for each NMOC Morning Site datum in the 1989 program. The H's in the open vertical space locate the stem and leaf for the upper and lower hinges, and the M locates the stem and leaf for the median. The median separates the sorted NMOC concentrations into two equal halves; the hinges (or quartiles) separate each half into quarters. The "H spread" or inter-quartile range is the difference between the NMOC values of the two hinges.

Statistics shown for NMOC are number of cases, minimum, maximum, mean, median, standard deviation, standard error, skewness, kurtosis, and the two hinges. Each NMOC determination is the average of two or three injections of the site sample.

The standard error is the standard deviation divided by the square root of the number of cases. Positive skewness is a third moment about the mean value, and characterizes a tail to the right of the mean value. A normal Gaussian distribution has a skewness of zero. The skewness of 2.46 for the 1989 NMOC data suggests a lognormal frequency distribution; that is supported

```
 0      44444 55555 55555
 0      66666 66777 77777
 0      88888 88888 88888 99999 99999 99999 99
 1      00000 00000 00000 00000 11111 11111 11111 11
 1      22222 22222 22222 22222 22222 33333 33333 33333 33333 3
 1      44444 44444 44444 44444 44555 55555 55555 55555 55555 55555 5
 1      66666 66666 66666 66666 66666 66666 66666 67777 77777 77777 77777 77
 1      88888 88888 88888 88888 88888 88888 88899 99999 99999 99999 99999 99999 99999 99999
 2      00000 00000 00000 00000 00000 00000 00000 01111 11111 11111 11111 11111 111
 2      22222 22222 22222 22222 22222 22223 33333 33333 33333 33333 3
 2   H  44444 44444 44444 44444 44444 44444 45555 55555 55555 5555
 2      66666 66666 66666 66666 66666 66777 77777 77777 77777 77777 7777
 2      88888 88888 88888 88888 88889 99999 99999 99999 9999
 3      00000 00000 00000 00000 00000 00000 00001 11111 11111 11111 11111 11111 1
 3      22222 22222 22222 22222 22233 33333 33333 33333 33333 33333 33
 3      44444 44444 44444 44445 55555 55555 55555 55
 3      66666 66666 66666 66666 66666 67777 77777 77777 77777 7777
 3      88888 88888 88999 99999 99999 99999 99999 99999 99
 4      00000 00000 00000 00000 11111 11111 11111 111
 4   M  22222 22222 22222 22333 33333 33333 33333 33
 4      44444 44444 44444 55555 55555 55555
 4      66666 66667 77777 77777 77777 7
 4      88888 88888 88889 99999 99999 99999
 5      00000 00000 00011 11111 11111 11111 11111 11111
 5      22222 22222 22222 22222 22222 23333 33333 33333 333
 5      44444 44444 44444 45555 55555 55555 55555 555
 5      66666 66666 66666 66667 77777 77777 77
 5      88888 88888 89999 99999 99999 9
 6      00000 00000 00000 00000 00000 11111 11111
 6      22222 22222 33333 33333 33333
 6      44444 44444 45555 55555 55
 6      66666 66666 66667 77777 77
 6      88888 88888 89999 99
 7      00000 00000 1111 1111
 7      22222 22222 22233 33333 333
 7   H  44444 44455 55555 5
 7      66666 66677 77777 77777
 7      88888 88899 99999 999
 8      00000 00000 1111
 8      22222 23333 333
 8      44444 55555
 8      66666 66666 77777 77777 77
 8      88888 88899 99
 9      00000 00011 11111 111
 9      22222 22223 33333 33
 9      44444 55555 55
 9      66666 66666 66677 7
 9      88888 89
10      00000 00011 11111
10      22333 3
10      44444 45
10      67777 777
10      66899 99999 999
11      00001 11111
11      22223 33
11      44455 5555
11      66667 777
11      8899
12      00011 1
12      22222 3333
12      44444 55
12      66666 777
12      88899
13      01
13      2223
13      445555 55555 5
13      67777
13      8899
14      00011 11
14      23
14      4444
14      77
14      899
15      0
15      01334 44678 99
16      01344 45556 6778
17      00333 44578 899
18      01466 7788
19      23455 66678 9
20      49
21      2348
22      15
23      022
24      4599
25      15
26      16
27      9
28      35
29      9
31      3
32      2
34      4
36      9
39      9
40      4
50      1
```

	NMOC, ppmC
Cases	1784
Minimum	0.043
Maximum	5.013
Mean	0.577
Standard Deviation	0.493
Standard Error	0.012
Skewness	2.460
Kurtosis	10.327
Lower Hinge (H)	0.242
Median (M)	0.434
Upper Hinge (H)	0.747

2793524R

Figure 5-1. Stem-and-leaf plot of the 1989 morning NMOC data.

by the fact that for the logarithm of the NMOC value (ln(NMOC)) (see Figure 5-2), skewness equals -0.087, which is close to zero. Kurtosis is the fourth moment about the mean and relates to the pointedness of the distribution. A distribution more pointed than a normal distribution, having the same standard deviation, has a kurtosis greater than 3.0.

Figure 5-2 is a stem-and-leaf plot of the 1989 ln(NMOC) data. The plot shows an approximately symmetrical distribution (skewness = -0.087). The kurtosis equal to -0.274 indicates the ln(NMOC) distribution to be less pointed than a normal distribution.

The shape of the stem-and-leaf plots suggests a lognormal distribution. Figures 5-3 and 5-4 support the lognormal distribution hypothesis for NMOC. The vertical scales in Figures 5-3 and 5-4 are arranged so that if the cumulative frequency of occurrence of NMOC were normally distributed, the numbers would plot into a straight line. The line in Figure 5-3 has a noticeable concave downward trend, indicating that the data do not fit a normal distribution well. Figure 5-4 plots the logarithm of NMOC on the same vertical scale. The fact that the digits on the graph plot into approximately a straight line supports the hypothesis that the NMOC data are approximately lognormally distributed. An asterisk on the graph indicates the location of a single datum. Integers, such as 2, 6, or 9, show the location of the corresponding number of data points. The number 999 shows the approximate location of either 27 data points or 99 + 9 data points. The results, although qualitative, show a dramatic difference between the normal and lognormal hypotheses, and suggest that the latter more nearly describes the NMOC data. Figure 5-4 is labeled a "Normal Probability Plot," but since the independent variable is the logarithm (to the base e) of NMOC, if the relation between the EXPECTED VALUE and ln(NMOC) is linear, a lognormal distribution is obtained.

5.2 MONTHLY VARIATIONS, 1984 - 1989

Table 5-1 partitions the NMOC data for the summer of 1989 into groups which correspond to monthly intervals.

The median, mean, and maximum NMOC concentration for September appear higher than for June, July, or August, but no clear trend is seen for the summer of 1989. Arithmetic means are used in Table 5-1 in spite of the

```
-31       4
-30       7610
-29       66322 0
-28       9883
-27       94332 1
-26       83220
-25       97431 10
-24       98865 44433 11
-23       99888 88766
-22       99987 76655 55444 42111
-21       99888 87776 65554 22110 00
-20       99888 88877 77766 55554 43221 11000 0
-19       98888 77766 55554 44433 32221 11110 00
-18       99998 88888 87777 66666 55544 44443 32222 22211 11100 00000
-17       99999 99988 77777 77776 55544 43333 22222 11100 0
-16       99999 99999 99888 88877 77666 66666 66555 55555 44333 33333 32222 22221 11111 00000 0
-15       99999 99999 88888 87777 77777 76666 65555 44444 44333 33333 22221 11111 11000 00000 00
-14  H    99998 88888 77776 66666 66655 44444 33332 22222 22222 11111 11110 0000
-13       99999 99888 77777 76666 65555 44333 33333 33222 22222 11111 11100 00000 00000 0
-12       99999 88887 77777 76666 66666 66555 55444 44433 33322 22211 11111 00000 0
 11       99999 99998 88888 88888 87777 77777 77766 66666 65555 55555 55544 44433 33333 32222 21111 11111 10000 00000
-10       99999 99999 98888 88887 77777 77776 66655 55554 44443 33333 33222 22222 22111 11111 11110 00000
 -9       99999 99998 88887 77777 77777 77666 65555 44444 33333 33333 33333 32222 22222 22221 11110 00000 000
 -8  M    99999 99988 88888 77777 77766 66665 55555 55555 44443 33333 33333 33222 22111 10000 00000 0
 -7       99999 99888 88887 77777 77665 55554 44444 44433 33332 22222 22211 11100 000
 -6       99999 99999 99888 88777 77766 66666 66666 66666 55555 55555 55554 44444 44444 44333 33333 333333 33222 22221 11111 11100 00000 0
 -5       99999 99999 99999 88888 88887 77777 76666 66666 66666 66655 55544 44433 33333 32222 22221 11111 11100 00000 00000 00000 00
 -4       99999 99998 88888 77777 77666 66666 55555 55544 44444 33333 33222 22211 11111 11110 00000 00000
 -3       99999 88888 87777 77776 66555 55554 44444 33333 33222 22211 11111 11111 10000 0
 -2  H    99999 99888 87777 77666 66666 55555 55555 44444 33333 33322 22222 21111 11100 0
 -1       99999 88888 87777 66666 66554 44444 44443 33333 33333 22222 21111 00000 000
 -0       99999 99998 88877 77777 77777 66666 55555 55444 44443 33333 33333 22211 11110
  0       00000 00001 11111 22233 34444 44566 67777 77888 88889 99999 99
  1       00000 00112 22223 33444 44445 55666 66778 88899 99
  2       00001 11111 22222 33333 44445 55567 77889 99
  3       00000 00000 11112 23344 44444 55666 6899
  4       00011 23333 55566 67789 99
  5       00011 11233 44555 67778 899
  6       12223 33556 67777 789
  7       13556 79
  8       13449 9
  9       11236 7
 10       2449
 11       46
 12       3
 13       089
 16       1
```

	ln(NMOC)
Cases	1784
Minimum	-3.147
Maximum	1.612
Mean	-0.853
Standard Deviation	0.792
Standard Error	0.019
Skewness	-0.087
Kurtosis	-0.274
Lower Hinge (H)	-1.420
Median (M)	-0.836
Upper Hinge (H)	-0.292

2793525R

Figure 5-2. Stem-and-leaf plot for the morning ln(NMOC) data.

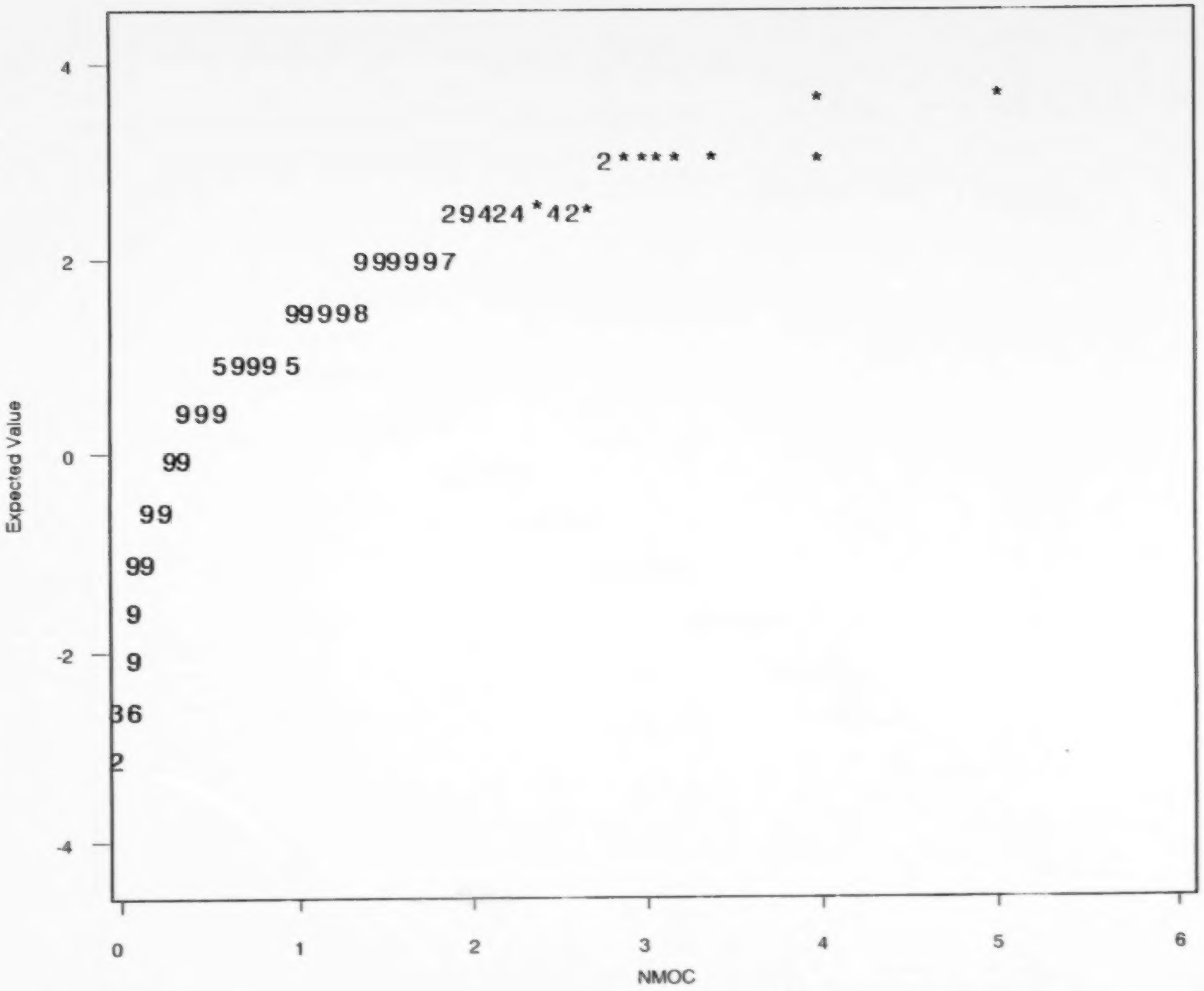

Figure 5-3. Cumulative frequency distribution for 1989 NMOC data.

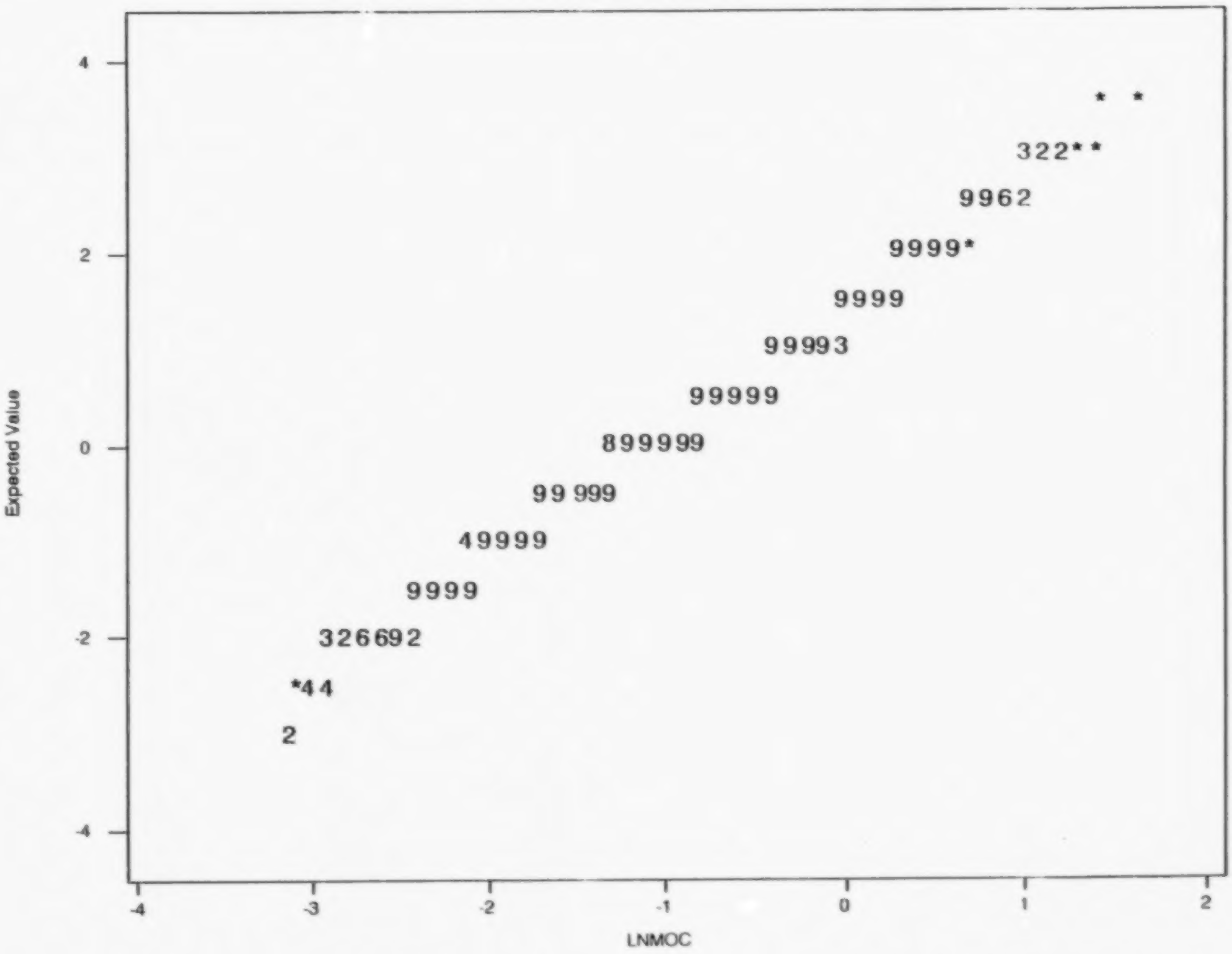

Figure 5-4. Cumulative frequency distribution for 1989 ln(NMOC) data.

2793539R

TABLE 5-1. SUMMARY STATISTICS FOR 1989 MORNING NMOC SITES, BY MONTH

Sample Month 1989	Minimum NMOC ppmC	Median NMOC ppmC	Mean NMOC ppmC	Maximum NMOC ppmC	Standard Deviation NMOC ppmC	Cases
June	0.059	0.396	0.510	3.693	0.403	419
July	0.052	0.428	0.542	3.443	0.420	426
August	0.043	0.405	0.540	3.134	0.451	503
September	0.046	0.530	0.718	5.013	0.637	436

observations given in Section 5.1 which conclude that the frequency distribution of NMOC concentrations in ambient air are logarithmic normal distributed. Comparison of Tables 2-2 and 2-3 containing site average concentrations for the Gaussian and lognormal distributions, respectively, emphasize that the lognormal means may be less than, equal to, or greater than the respective arithmetic means. In all cases the means are within 10% of one another. Either the arithmetic means, or the mean of the lognormal distribution may be used as a measure of central tendency of the data. Table 5-1 also gives monthly minima, medians, and maxima. These latter three statistics are independent of the probability distribution from which they derive.

Figures 5-5 through 5-8 give the stem-and-leaf plots of the NMOC data for June, July, August, and September 1989, respectively. All the plots show the general shape of lognormal distribution. The data for June, July, August, and September may be considered typical of the sites tested during the indicated time period. Monthly mean NMOC emissions are plotted in Figure 5-9 for 1984, 1985, 1986, 1987, 1988, and 1989. No general trends are evident for the years shown. For five of the six years, September means are higher than August means, and for four of the six years, July means are less than June means. At present, however, it must be concluded that random behavior is responsible for apparent month-to-month changes.

During the six years of the NMOC Monitoring Program, three sites participated in the program for all six years. Two sites have been in the program 4 years; 7 sites for 3 years; 18 sites for 2 years; and 61 sites for only 1 year. In all cases the sites were urban sites, but it is difficult to draw conclusions from year to year because of the difference in yearly site participation.

The April and May NMOC monitoring data for 1988 were from only four Florida sites, M1FL, M2FL, T1FL, and T2FL. The remainder of the points located on the 1988 trend line included data from 45 NMOC Monitoring Program sites.

5.3 SPECIAL STUDY

This section summarizes the results of a special study designed to characterize, compare, and qualify NMOC monitoring data from 1984 through

```
 0       56677 999
 1       00000 11111 22222 22333 33344 44445 55555 55555 55566 66666 77777 77888 88888 88999 99999 9
 2  H    00000 00000 11111 22222 22222 33333 33344 44445 55566 66777 78888 88999 999
 3  M    00000 00000 01111 12222 22333 33334 44455 56666 66666 77777 77888 89999
 4       00011 11223 33333 33445 55556 77777 88899
 5       00011 11111 12222 22233 34444 55555 66667 99
 6  H    00000 01112 23333 44455 56666 67778 88999
 7       00111 22222 23345 55566 77889 9999
 8       00002 24456 77788
 9       00111 22233 45556 6
10       00113 34479
11       00014 78
12       0368
13       23567
13       6
14       28
15       9
16       1
17       348
18       7
19       69
21       4
22       5
36       9
```

	NMOC, ppmC
Cases	419
Minimum	0.058
Maximum	3.693
Mean	0.510
Standard Deviation	0.402
Standard Error	0.019
Skewness	2.414
Kurtosis	10.890
Lower Hinge (H)	0.220
Median (M)	0.395
Upper Hinge (H)	0.684

2793526R

Figure 5-5. Stem-and-leaf plot of the morning NMOC data for June, 1989.

```
0       56888 88999
1       00011 11222 22222 33344 45555 66667 77778 88888 88888 89999 99999 9999
2  H    00000 00000 01111 11111 22222 22333 34444 44444 44555 55566 66667 77788 88888 88899 9
3       00000 00001 11111 22222 23333 33444 44444 45566 66777 78889 99999 99999 99
4  M    00011 11122 22333 33344 44444 45567 77788 88899 99999 9
5       00000 11111 11112 22222 23444 55556 66777 77888 88999 999
6       00000 11223 34555 56788 9
7  H    00111 22334 47777 8899
8       00122 45556 66778 8999
9       00022 23445 55666 788
10      00344 57778 999
11      11123 55567 8
12      03346 6789
13      355
14      119
15      347
16      4566
17      59
21      3
24      49
34      4
```

	NMOC, ppmC
Cases	426
Minimum	0.051
Maximum	3.443
Mean	0.542
Standard Deviation	0.419
Standard Error	0.020
Skewness	2.138
Kurtosis	7.596
Lower Hinge (H)	0.245
Median (M)	0.427
Upper Hinge (H)	0.712

2793527R

Figure 5-6. Stem-and-leaf plot of the morning NMOC data for July, 1989.

```
 0      44555 56777 77888 88889 999
 1      00000 00000 11111 11222 22233 33333 44444 44455 55556 66666 66666 77777 77888 88889 99999 9
 2 H    00000 00000 00111 11122 22233 33333 44444 44455 55555 56666 66666 77777 77777 78888 88999 99999
 3      00000 00011 11111 11111 22223 33333 33344 45555 55555 66666 66777 77788 88999 9999
 4 M    00000 00001 11111 11222 22223 34444 45555 66777 77788 9999
 5      00001 12222 22333 33445 55566 66666 67777 88889 99
 6 H    00000 01111 22223 33333 34444 44455 66777 889
 7      00011 22333 33444 55556 67779 99
 8      00012 33346 66666 77777 89
 9      01111 13456 66667 89
10      00011 77899 99
11      02456 9
12      11467
13      44578
13      9
14      00144 9
15      499
16      47
17      03478 9
18      01467 8
19      58
20      49
23      2
24      9
26      6
31      3
```

	NMOC, ppmC
Cases	503
Minimum	0.043
Maximum	3.134
Mean	0.540
Standard Deviation	0.450
Standard Error	0.020
Skewness	1.929
Kurtosis	4.792
Lower Hinge (H)	0.233
Median (M)	0.404
Upper Hinge (H)	0.697

2793528R

Figure 5-7. Stem-and-leaf plot of the morning NMOC data for August, 1989.

```
 0      44455 55666 78889 99999 9
 1      00122 22333 33444 44555 55666 66666 66666 67788 88999
 2 H    00011 11111 22222 22333 44444 46666 66667 77777 77889 99
 3      00000 01111 22222 22333 33334 44555 55666 66677 77778 99999 99
 4      00000 12222 33335 55566 66677 88889 9
 5 M    01111 11112 22222 33333 33344 44444 55555 55556 66677 78899 99
 6      00000 00011 22335 56666 66788 889
 7      00012 22344 66667 77888 8
 8      01123 33345 77889
 9 H    00112 22333 34666 7888
10      01112 23446 7899
11      11223 34556 6779
12      01222 22344 45567 89
13      01225 55557 79
14      01344 77
15      00134 66
16      03455 67
17      03
18      66
19      23456 67
21      28
22      1
23      2
24      5
25      15
26      1
27      9
28      35
29      9
32      2
39      9
40      4
50      1
```

	NMOC, ppmC
Cases	436
Minimum	0.046
Maximum	5.012
Mean	0.717
Standard Deviation	0.637
Standard Error	0.030
Skewness	2.316
Kurtosis	8.416
Lower Hinge (H)	0.282
Median (M)	0.538
Upper Hinge (H)	0.973

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Figure 5-8. Stem-and-leaf plot of the morning NMOC data for September,1989.

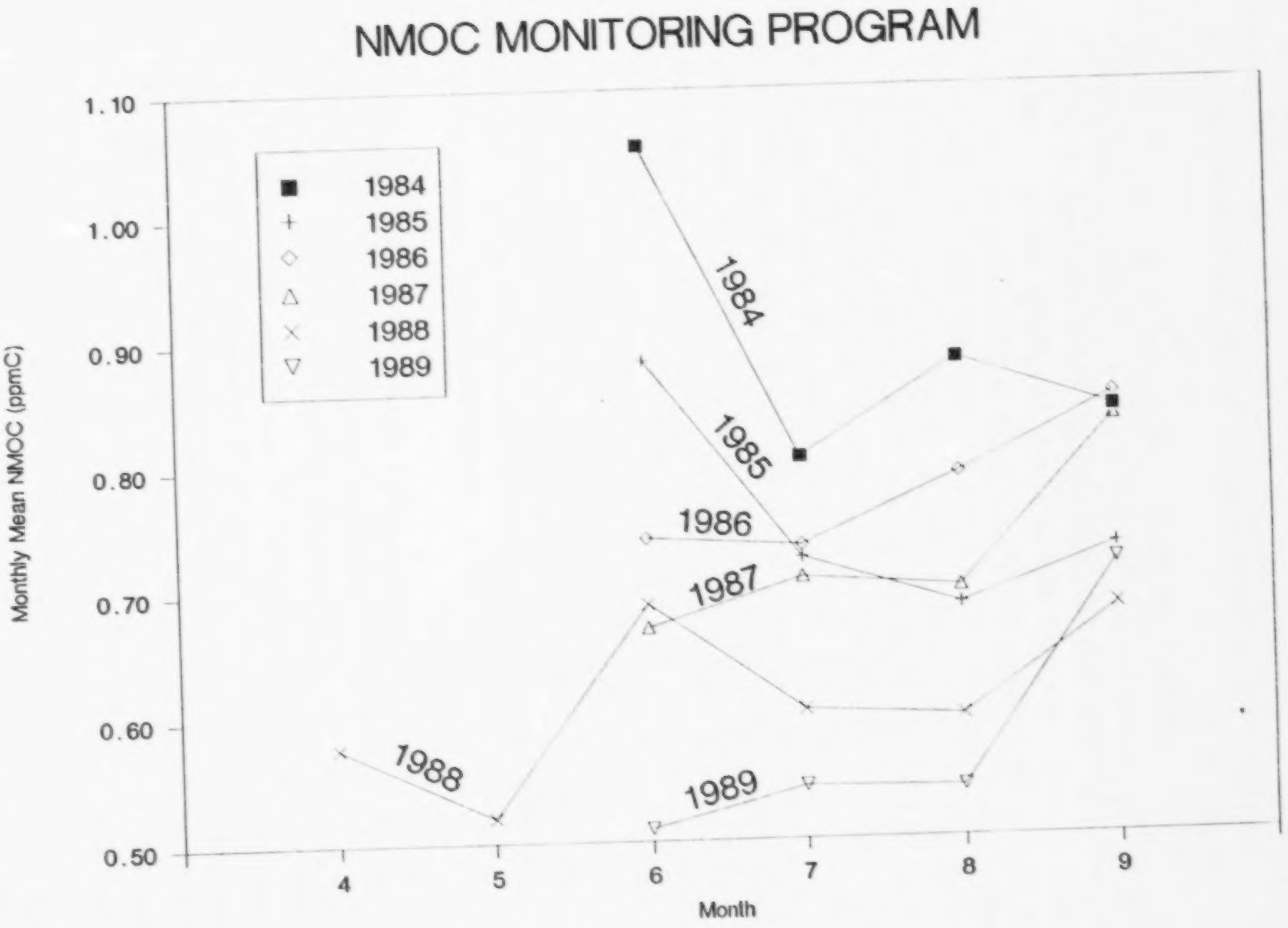

Figure 5-9. Monthly mean NMOC emissions for 1984 through 1989.

1988. Task 1 compared monthly average NMOC concentrations for 1988 with monthly average NMOC concentrations at the same site for years 1984 through 1987. A total of 18 sites participated in the NMOC Monitoring Program for the specified time periods.

Thirty-two monthly average NMOC concentrations were available for comparing 1984 data with 1988 data. In 28 out of 32 comparisons, monthly averages in 1988 were less than corresponding monthly averages in 1984. Thirty-nine monthly averages were available to compare 1985 with 1988; 34 out of 39 monthly averages in 1988 were less than corresponding monthly averages in 1985. Conclusions reached in Task 1 are that NMOC monthly average concentrations in 1988 were lower than corresponding monthly averages in 1984and 1985. The magnitude and pattern of the decreases for the 1988 data are site specific and specific to the years of the comparisons. It should be emphasized that even though the locations of the sites are the same from year to year, site average concentrations given in this study do not reflect the effects of meterological variables, wind speed and direction, solar radiation (presence of clouds), temperature, humidity, and changes in the topography that surrounds the site. Drawing conclusions relative to "average" site NMOC concentrations should be avoided without taking into account all of the meterological and topographical factors.

Comparison of 1988 monthly average NMOC concentrations with monthly average concentrations at the same site in 1986 and 1987 showed that no trends were discernable at the sites tested. Twenty-nine monthly comparisons were possible in 1986 and 48 in 1987.

Task 2 investigated correlation of maximum daily ozone concentrations with 6 a.m. to 9 a.m. NMOC concentrations for June and July 1988 at five urban centers -- New York, Newark, Plainfield, Houston, and Chicago. Maximum daily ozone concentrations at the urban site and at selected ozone receptor sites were plotted versus NMOC concentration at the urban source. Linear, quadratic, and cubic polynomial correlations were tested. Data involving Chicago were not useful in this study because there were insufficient data for the chosen time period. The remainder of the correlations showed significant linear relationships despite linear coefficients of regression lower than 0.550.

Task 3 was designed to relate canister age to NMOC concentration, at urban sites, and subsequently to maximum ozone at receptor sites, should measured NMOC concentration be a function of canister age. However, analysis of NMOC concentrations measured from duplicate sample canisters confirmed that no correlation existed between NMOC concentration and canister age.

5.3.1 Task 1

Task 1 compared monthly averages of NMOC concentrations for sites in the 1988 program with corresponding monthly averages for the same site that participated in the programs one or more previous years. Table 5-2 gives monthly NMOC concentration averages for June, July, August, and September for each site listed, showing the years the site participated in the monitoring program. Table 5-2 also shows the number of cases included in each monthly average. The number of cases at each site differed from year to year. For some sites there were considerable differences in the number of cases.

Certain of the monthly averages were derived from data obtained by Region III[12,13] and these data are flagged in Table 5-2. The remainder of the results in Table 1 were derived from data obtained by Radian Corporation.[3,5,6,7]

The Arlington, Virginia site data for 1987[13] were modified upon the recommendation of Region III.[14] There were three values of NMOC reported to be greater than 3.0 ppmC (3.621 on July 28, 9.061 on August 3, and 4.599 on September 23). Region III personnel have reason to believe that the sampling system was contaminated with acetone on those three days and recommended[14] that the values be removed from the data base for that reason.

Figures 5-10 through 5-27 display graphically the averages listed in Table 5-2. In general, the monthly average NMOC concentrations in 1985 are higher than the averages for 1988. The monthly averages for 1986 and 1987, on the other hand, show few trends when compared to the 1988 monthly averages. It is clear that any trends in the 1984 through 1988 monthly average NMOC concentrations are site specific. For example 1984 monthly averages for Beaumont, TX; Dallas, TX; El Paso, TX; Philadelphia, PA; and Washington, DC are clearly higher than 1988 monthly averages. Richmond, VA; Charlotte, NC; and Miami, FL on the other hand show a mixed comparison between 1984 and 1988.

TABLE 5-2. MONTHLY AVERAGE NONMETHANE ORGANIC COMPOUND CONCENTRATIONS

Year	June		July		August		September	
	Cases	Avg. NMOC Conc., ppmC	Cases	Avg. NMOC Conc., ppmC	Cases	Avg. NMOC Conc., ppmC	Cases	Avg. NMOC Conc., ppmC
Beaumont, TX (BMTX)								
1988	21	0.662	24	0.635	20	0.664	26	0.925
1987	25	0.590	26	0.757	23	0.548	27	0.823
1986	22	0.796	22	0.552	24	0.810	21	1.036
1985	22	1.992	25	2.103	25	1.558	21	1.391
1984	8	1.524	17	0.785	22	1.086	19	0.495
Dallas, TX (DLTX)								
1988	22	0.643	24	0.425	26	0.493	24	0.559
1987	21	0.836	23	0.531	20	0.518	21	0.687
1986	--	-	11	0.583	22	0.975	24	0.558
1985	19	1.112	22	0.737	22	0.892	19	0.735
1984	11	1.184	20	0.880	23	1.059	20	0.832
El Paso, TX (ELTX)								
1988	20	0.391	24	0.378	23	0.441	23	0.604
1987	24	0.369	23	0.362	23	0.430	23	0.589
1986	23	0.348	23	0.521	22	0.546	20	0.539
1985	22	0.862	33	0.673	25	0.578	21	0.735
1984	9	1.083	20	0.835	21	0.816	19	1.068
Philadelphia, PA (PHPA/P1PA)								
1988[a]	17	0.424	18	0.576	19	0.632	10	0.652
1987[a]	13	0.641	22	0.653	19	0.542	15	0.571
1986	23	0.443	22	0.488	24	0.421	--	-
1985	20	0.713	25	0.691	24	0.555	2	0.886
1984	2	0.940	20	1.030	24	0.896	17	1.191

(Continued)

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TABLE 5-2. (Continued)

Year	June Cases	June Avg. NMOC Conc., ppmC	July Cases	July Avg. NMOC Conc., ppmC	August Cases	August Avg. NMOC Conc., ppmC	September Cases	September Avg. NMOC Conc., ppmC
Washington, DC (WDC)								
1988	20	0.375	19	0.500	22	0.468	11	0.569
1987	22	0.519	22	0.478	20	0.476	17	0.509
1986	22	0.385	25	0.351	22	0.330	2	0.222
1985	11	0.890	24	0.608	25	0.653	3	0.865
1984	2	0.760	21	0.758	22	0.869	18	0.834
Houston, TX (H1TX)								
1988	12	1.208	22	0.980	26	1.032	23	1.113
1987	26	0.814	27	1.014	22	0.856	24	1.239
1986	22	1.130	25	0.823	21	1.215	23	1.333
1985	12	1.262	22	0.743	11	1.067	22	0.784
Baltimore, MD (BLMD)								
1988[a]	21	0.545	20	0.571	23	0.668	12	0.641
1987[a]	22	0.620	23	0.606	20	0.578	21	0.640
1986	17	0.565	24	0.588	21	0.534	--	-
New York, NY (MNY)								
1988	17	0.763	26	0.773	16	0.659	18	0.795
1987	17	0.751	22	0.764	21	0.784	19	0.724
1986	23	0.544	25	0.636	20	0.606	23	0.673

(Continued)

TABLE 5-2. (Continued)

Year	June		July		August		September	
	Cases	Avg. NMOC Conc., ppmC	Cases	Avg. NMOC Conc., ppmC	Cases	Avg. NMOC Conc., ppmC	Cases	Avg. NMOC Conc., ppmC
Richmond, VA (RVA)								
1988[a]	21	0.321	18	0.359	22	0.140	10	0.601
1985	19	0.699	23	0.458	25	0.491	--	-
1984	2	0.950	19	0.543	25	0.503	18	0.515
St. Louis, MO (SLMO)								
1988	19	0.783	23	0.585	24	0.642	23	0.667
1987	23	1.316	23	1.031	24	0.662	26	0.642
1985	22	0.758	21	0.793	21	0.645	23	0.669
Charlotte, NC (CHNC)								
1988	10	0.496	11	0.459	22	0.482	22	0.443
1984	--	-	15	0.377	25	0.490	20	0.716
Memphis, TN (MTN/M1TN)								
1988	20	1.046	20	0.977	20	0.895	24	0.883
1984	--	-	11	1.140	20	1.402	21	1.614
Miami, FL (MIF'								
1988		0.978	19	0.801	23	1.320	27	1.153
1984	--	-	--	-	12	1.622	19	1.121
Cleveland, OH (CLOH)								
1988	18	0.681	22	1.010	23	0.862	24	0.713
1985	12	0.818	22	0.728	26	0.889	22	0.984

(Continued)

TABLE 5-2. (Continued)

Year	June Cases	June Avg. NMOC Conc., ppmC	July Cases	July Avg. NMOC Conc., ppmC	August Cases	August Avg. NMOC Conc., ppmC	September Cases	September Avg. NMOC Conc., ppmC
Philadelphia, PA (P2PA)								
1988[a]	20	0.502	20	0.597	23	0.627	44	0.548
1985	18	0.582	21	0.721	21	0.778	2	1.034
Arlington, VA (ARVA)								
1988[a]	19	0.387	14	0.362	20	0.485	11	0.498
1987[a]	22	0.628	18	0.874	17	0.732	15	0.878
Boston, MA (B2MA)								
1988	18	0.858	23	0.646	23	0.494	27	0.592
1987	25	0.541	26	0.798	23	0.894	27	0.490
Newark, NJ (NWNJ)								
1988	21	0.876	21	0.868	25	0.755	26	0.707
1987	23	0.645	22	0.646	22	0.887	25	0.890

[a] Data from Region III study.

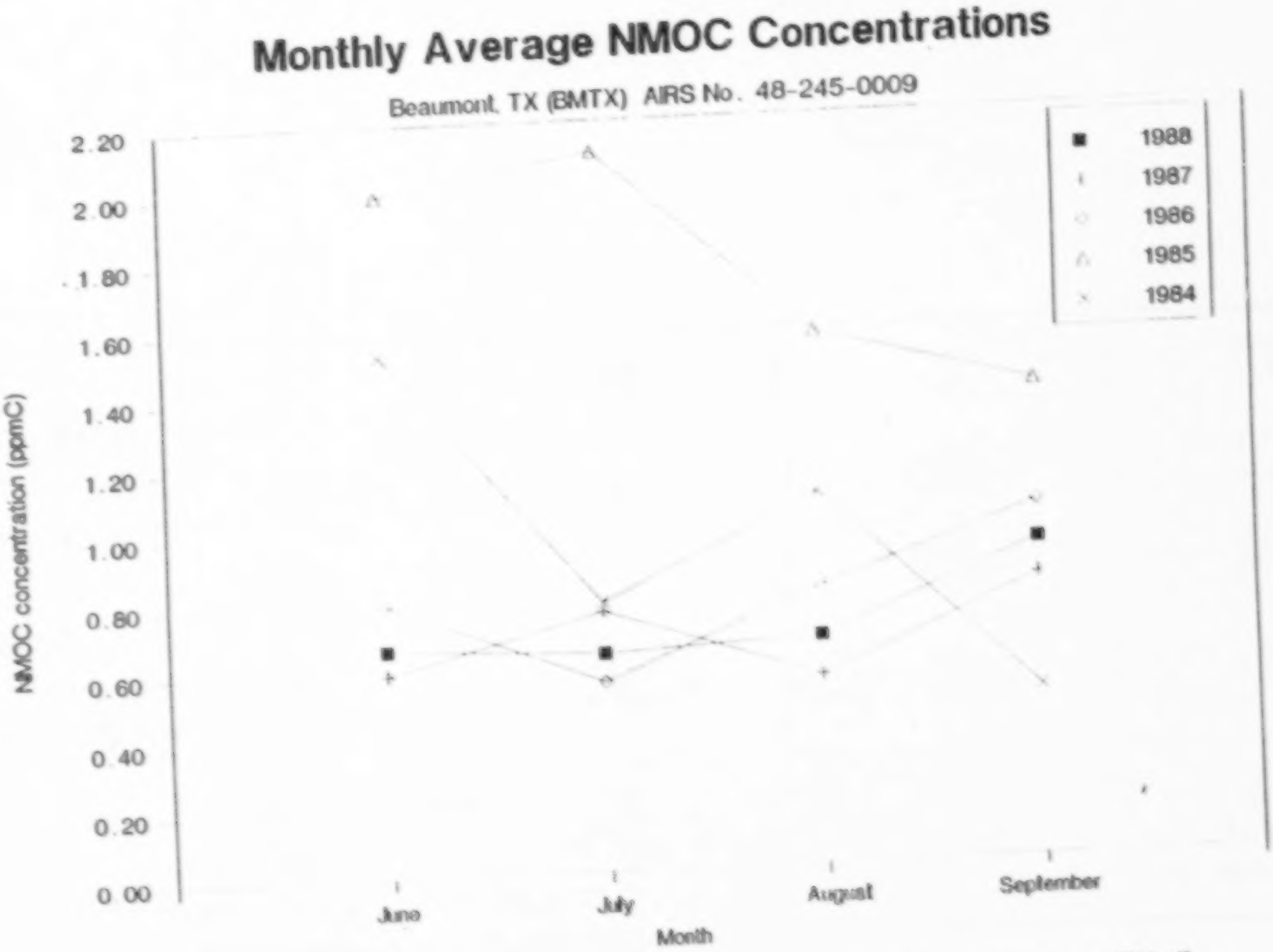

Figure 5-10. Monthly average NMOC concentrations for Beaumont, TX site.

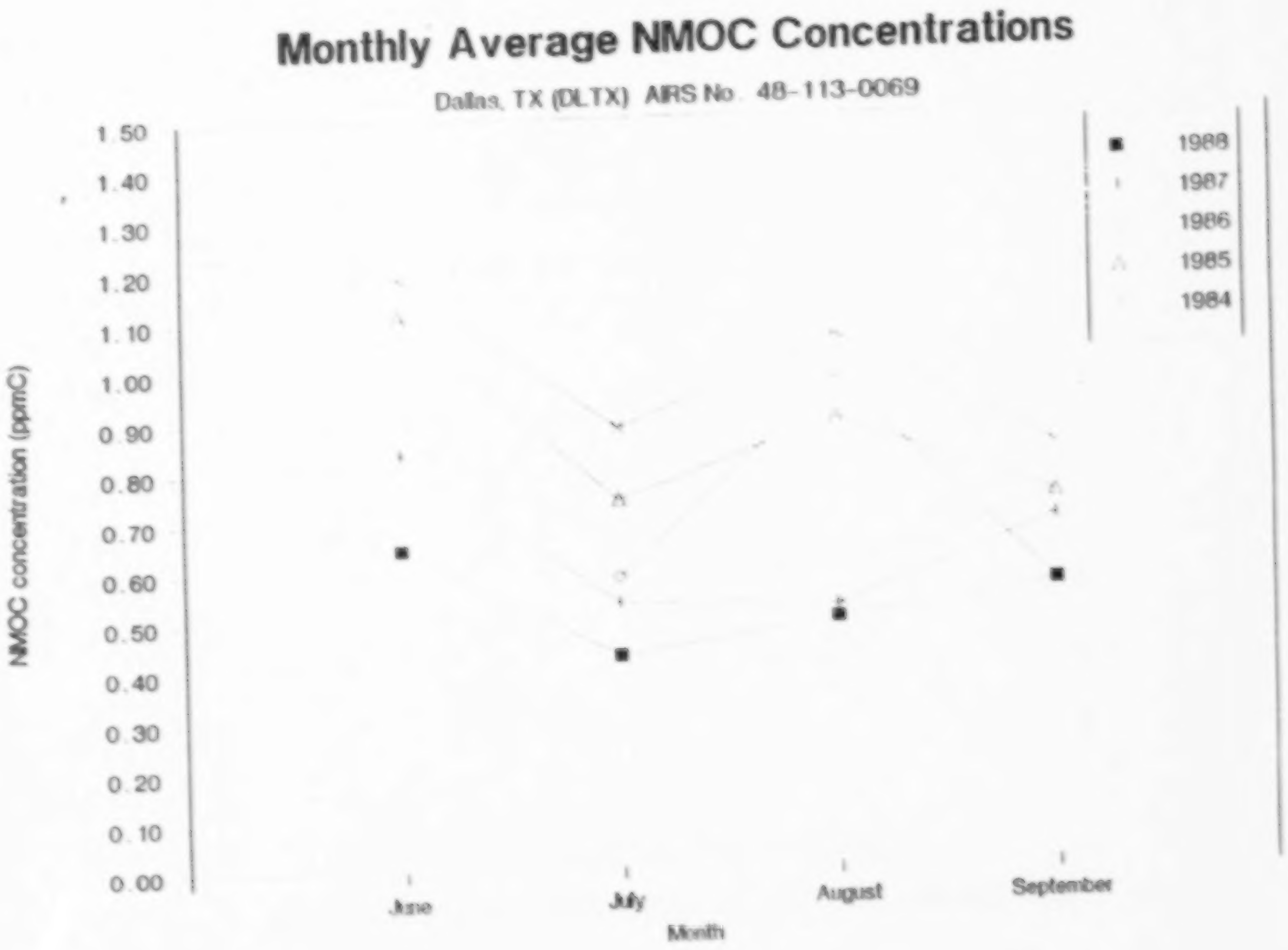

Figure 5-11. Monthly average NMOC concentrations for Dallas, TX site.

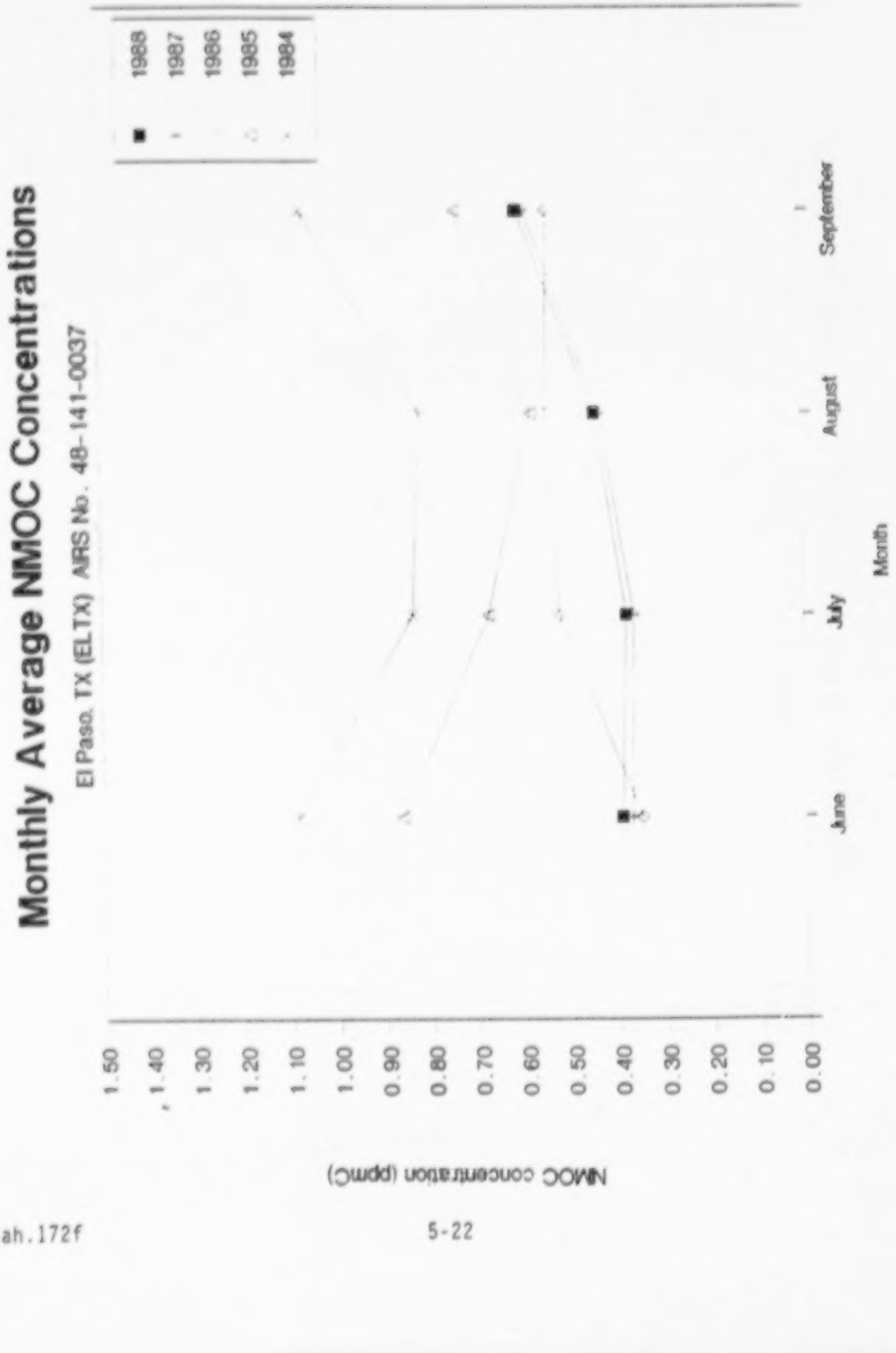

Figure 5-12. Monthly average NMOC concentrations for El Paso, TX site.

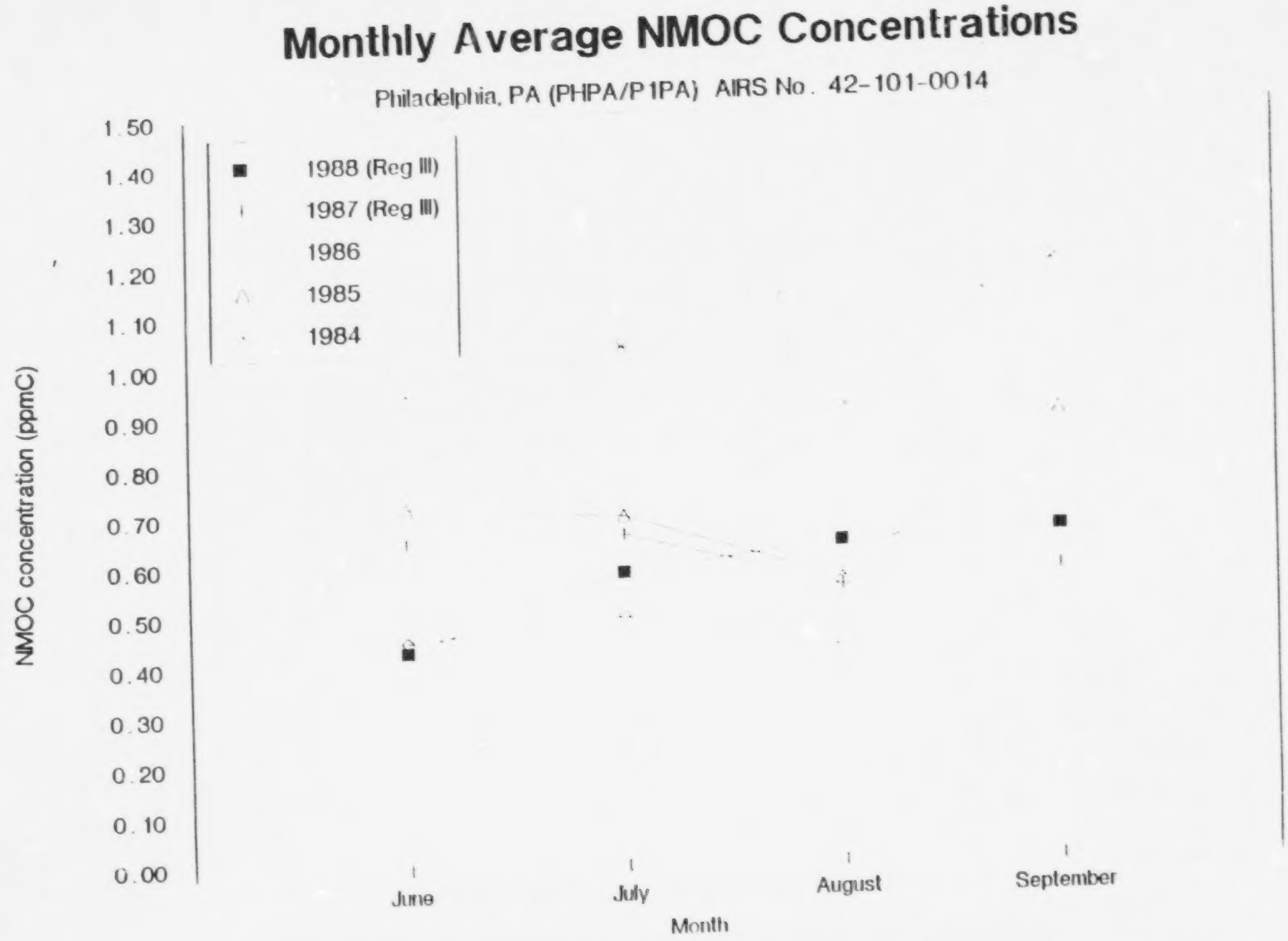

Figure 5-13. Monthly average NMOC concentrations for Philadelphia, PA site.

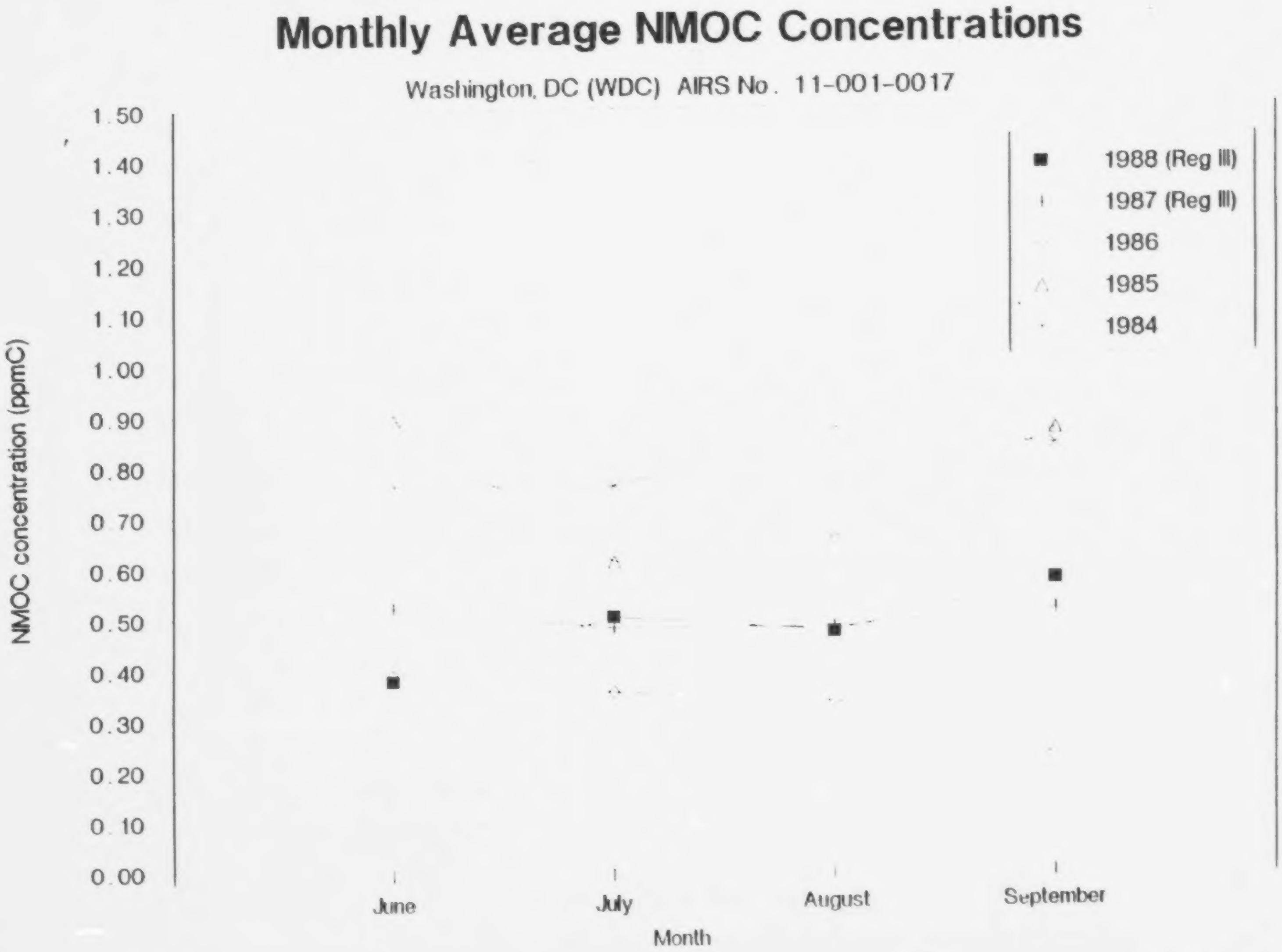

Figure 5-14. Monthly average NMOC concentrations for Washington, DC site.

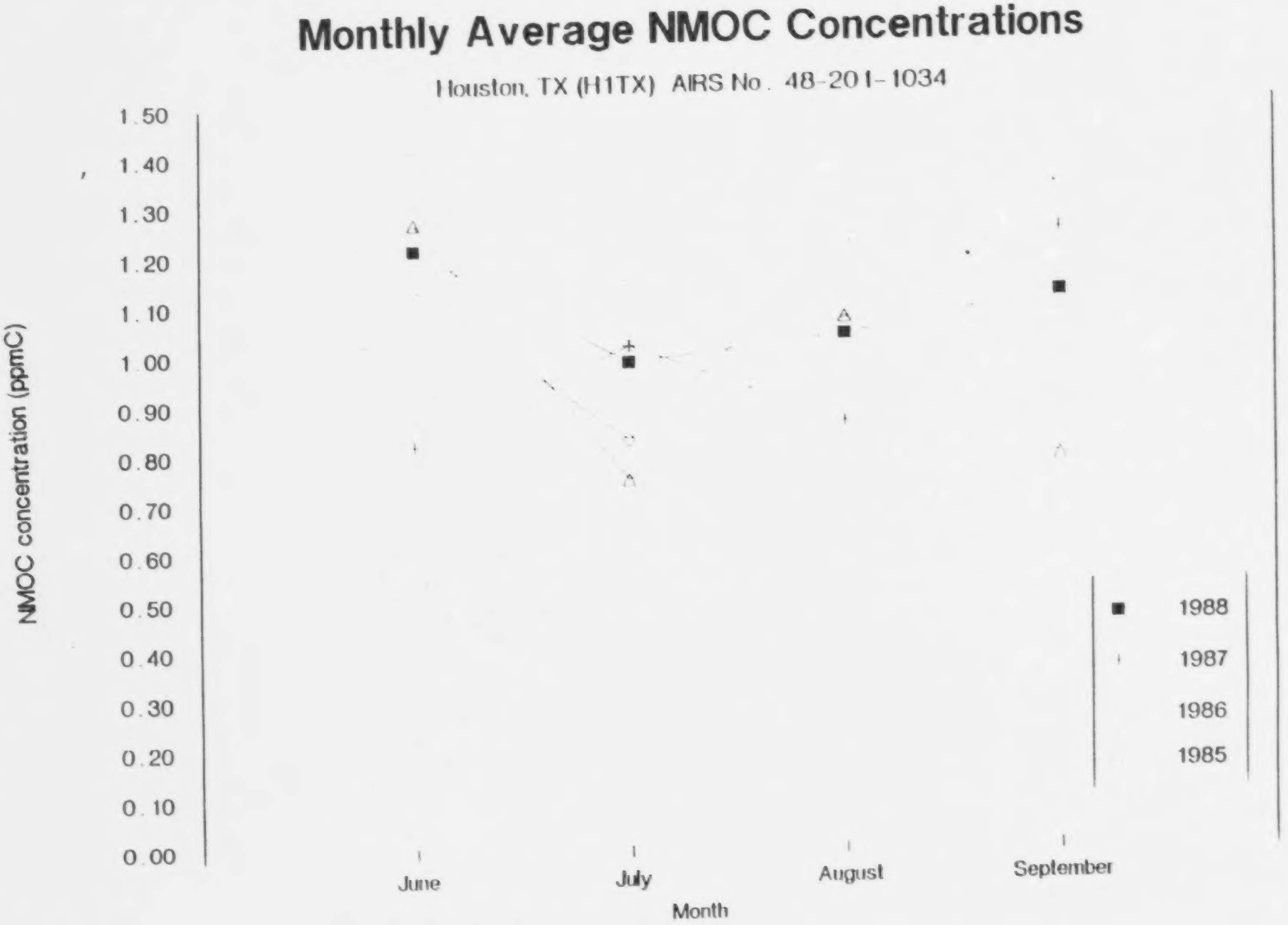

Figure 5-15. Monthly average NMOC concentrations for Houston, TX site.

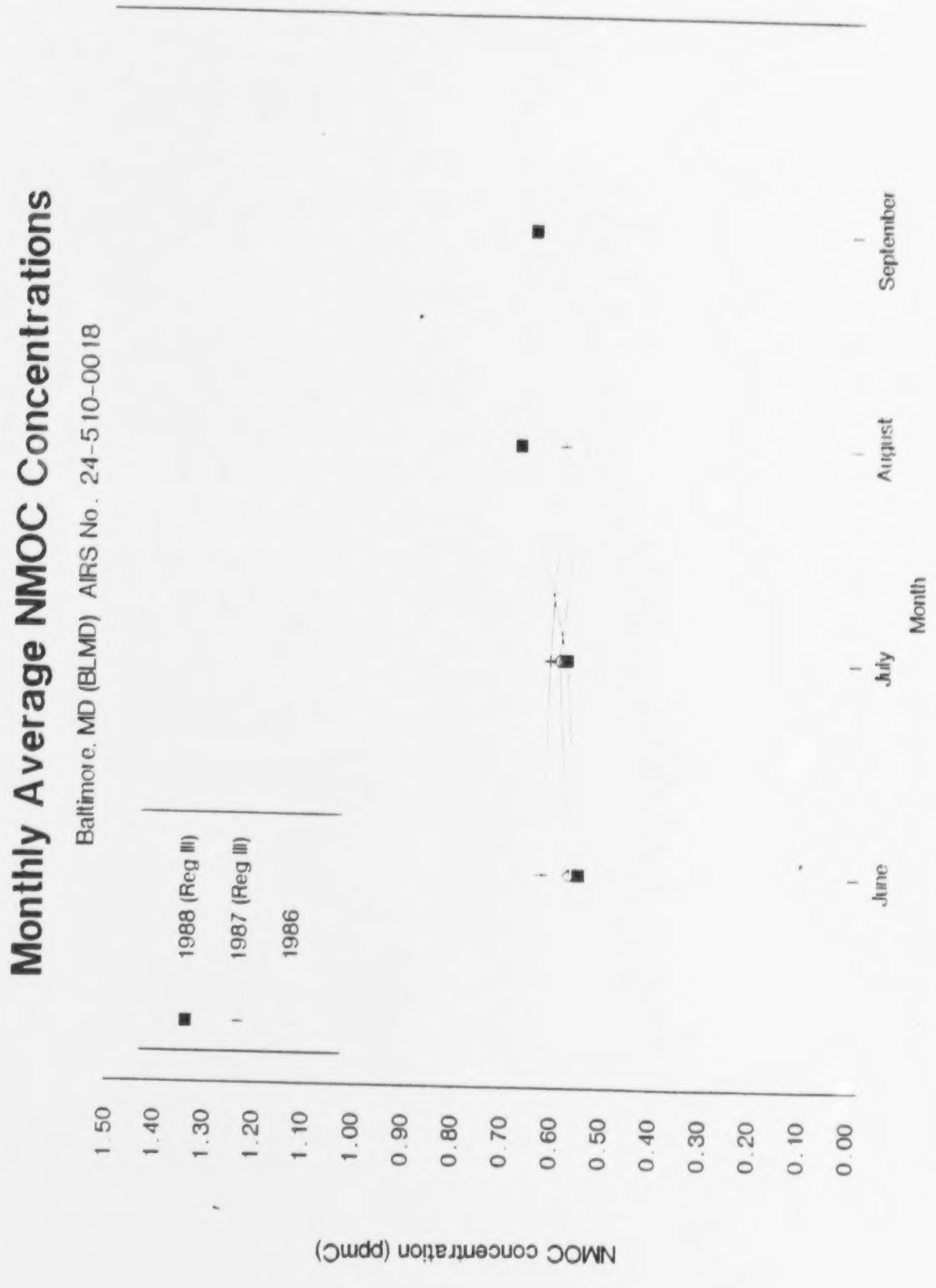

Figure 5-16. Monthly average NMOC concentrations for Baltimore, MD site.

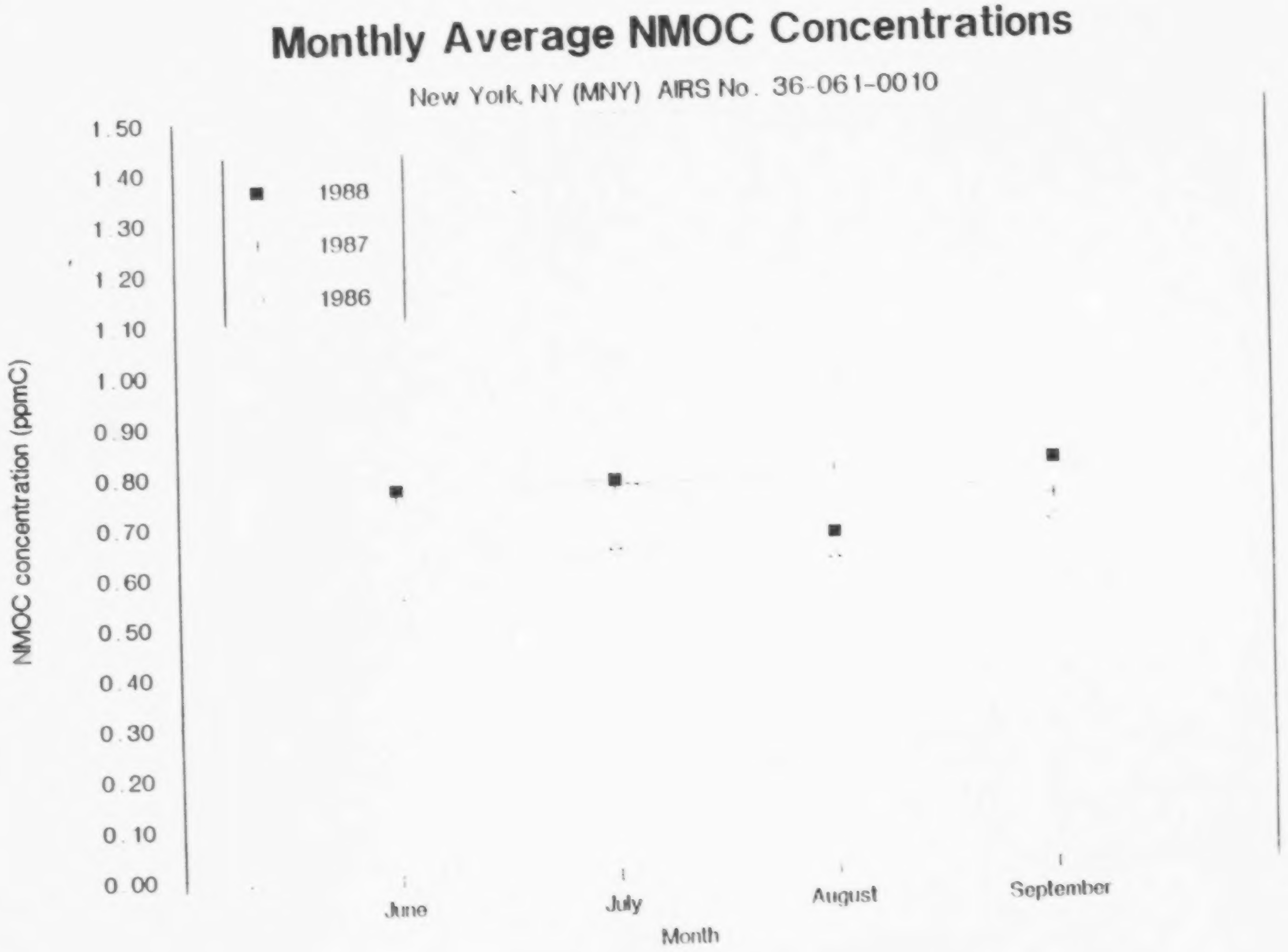

Figure 5-17. Monthly average NMOC concentrations for New York, NY site.

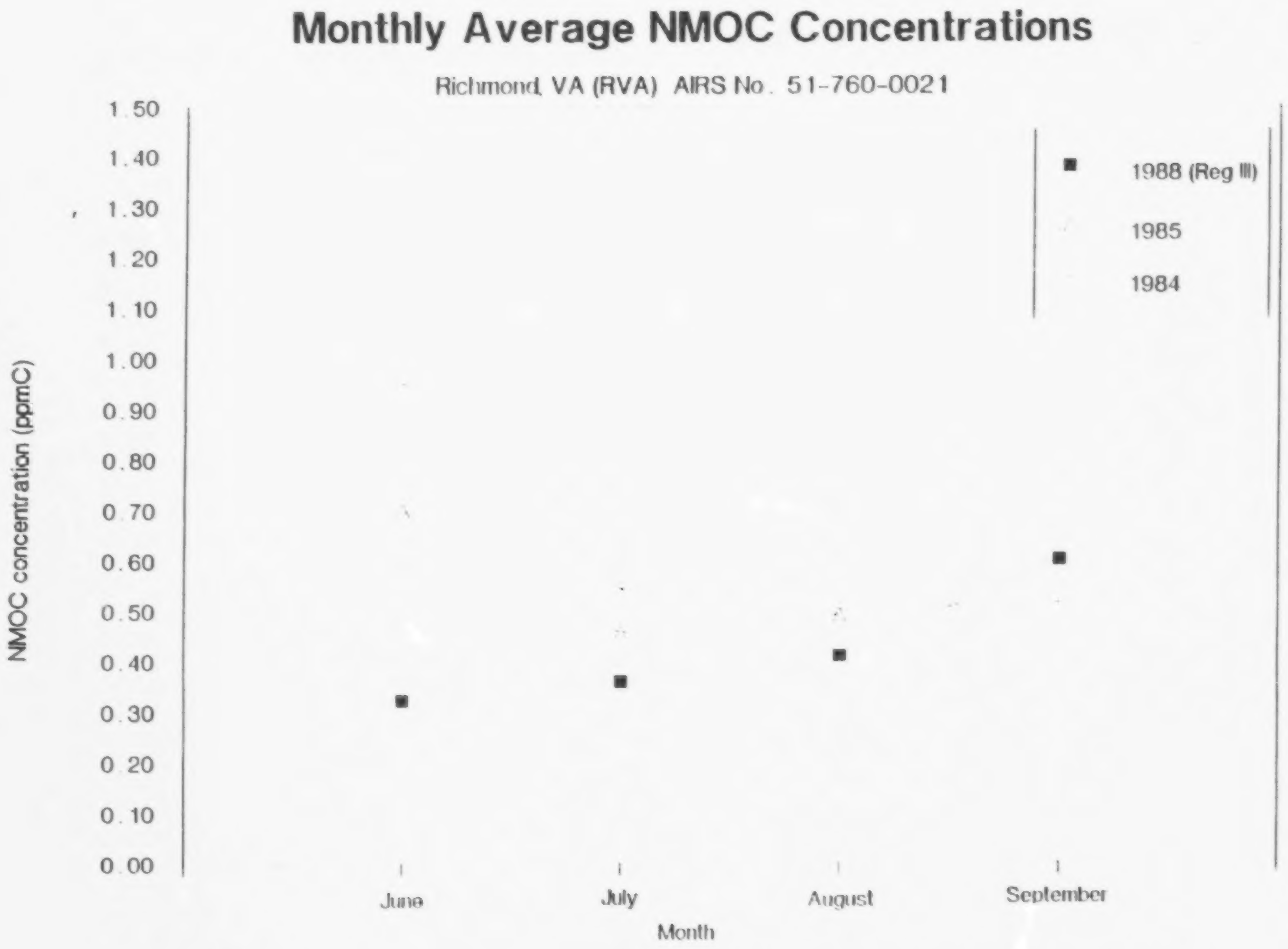

Figure 5-18. Monthly average NMOC concentrations for Richmond, VA site.

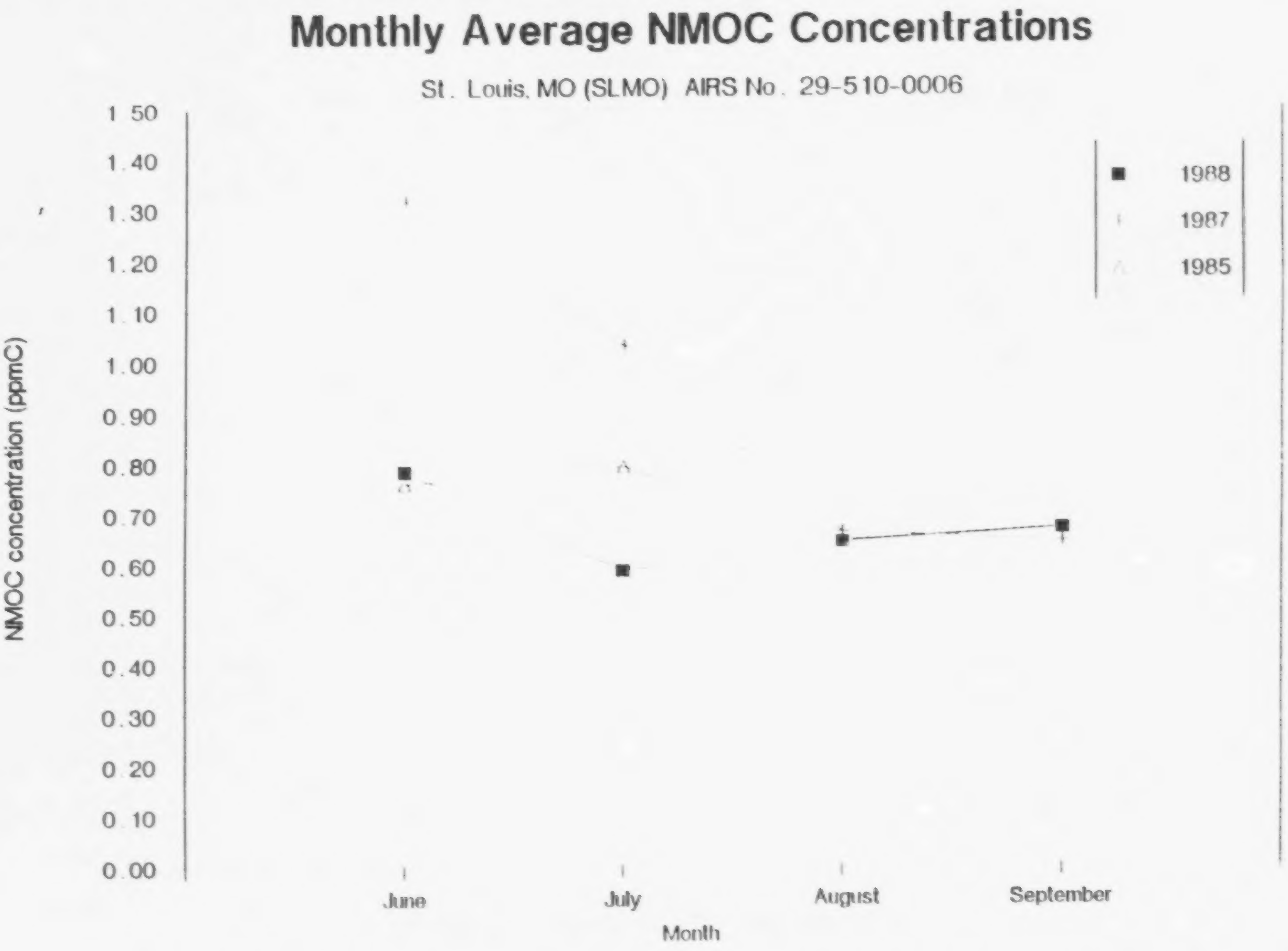

Figure 5-19. Monthly average NMOC concentrations for St. Louis, MO site.

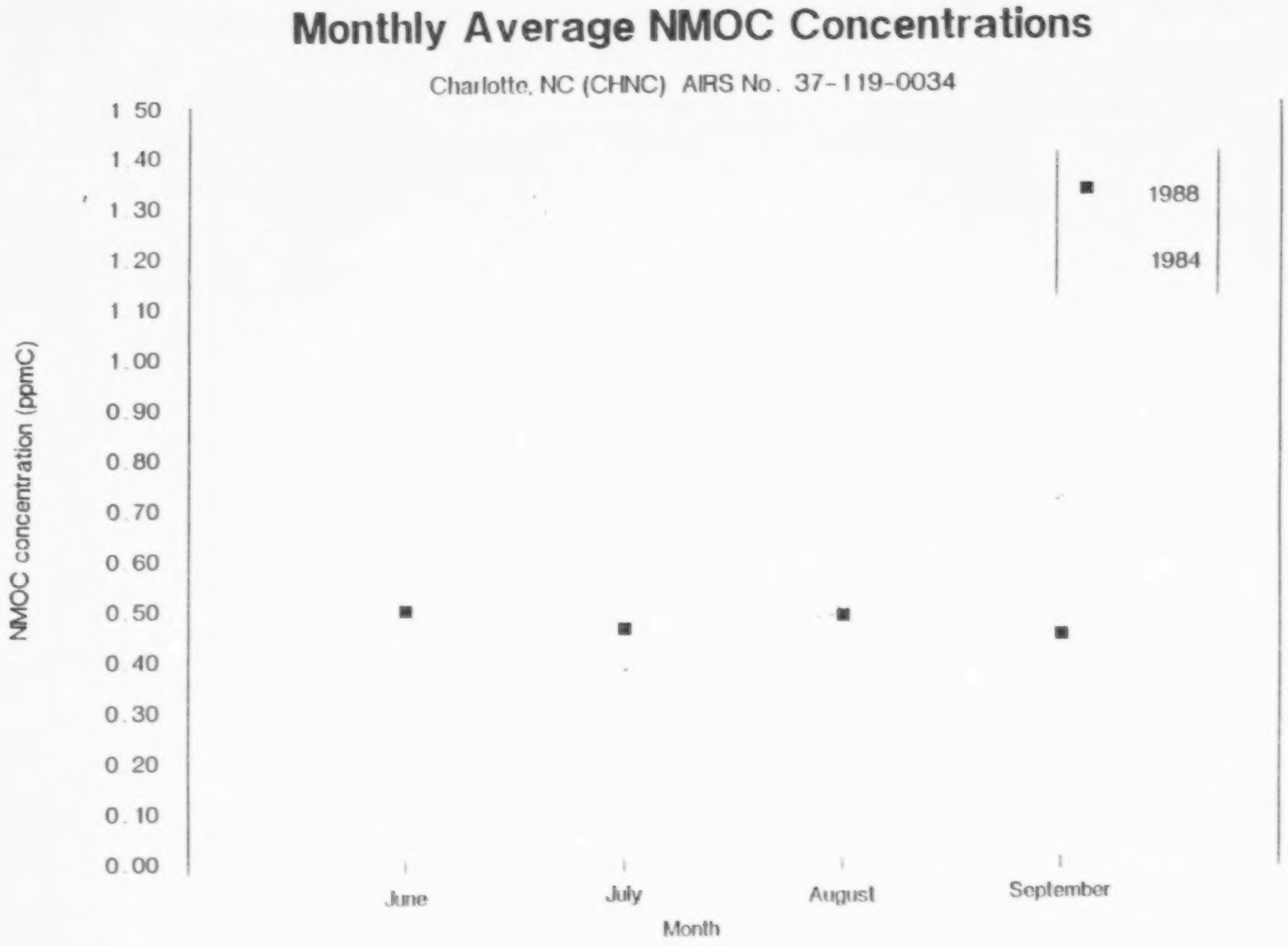

Figure 5-20. Monthly average NMOC concentrations for Charlotte, NC site.

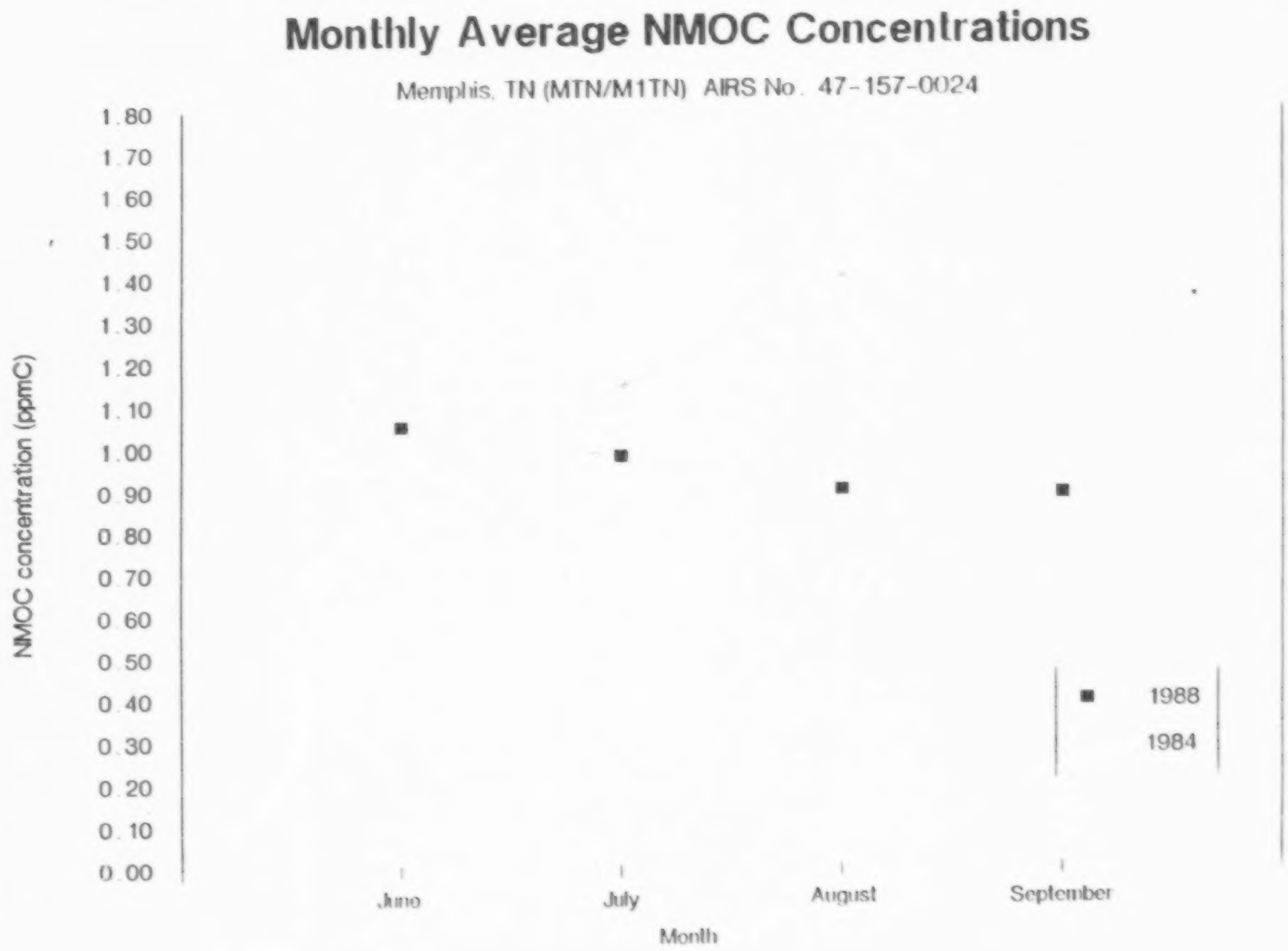

Figure 5-21. Monthly average NMOC concentrations for Memphis, TN site.

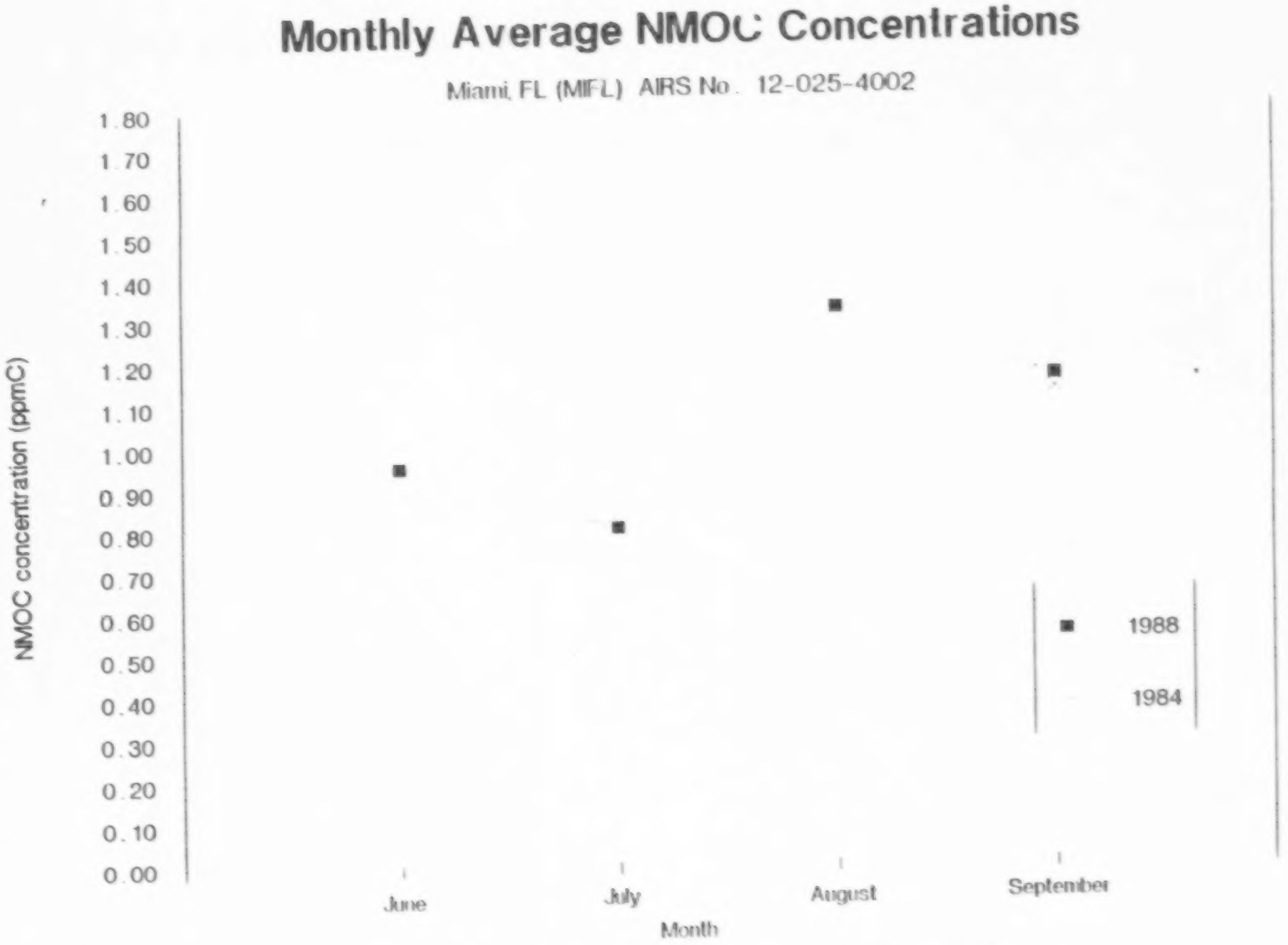

Figure 5-22. Monthly average NMOC concentrations for Miami, FL site.

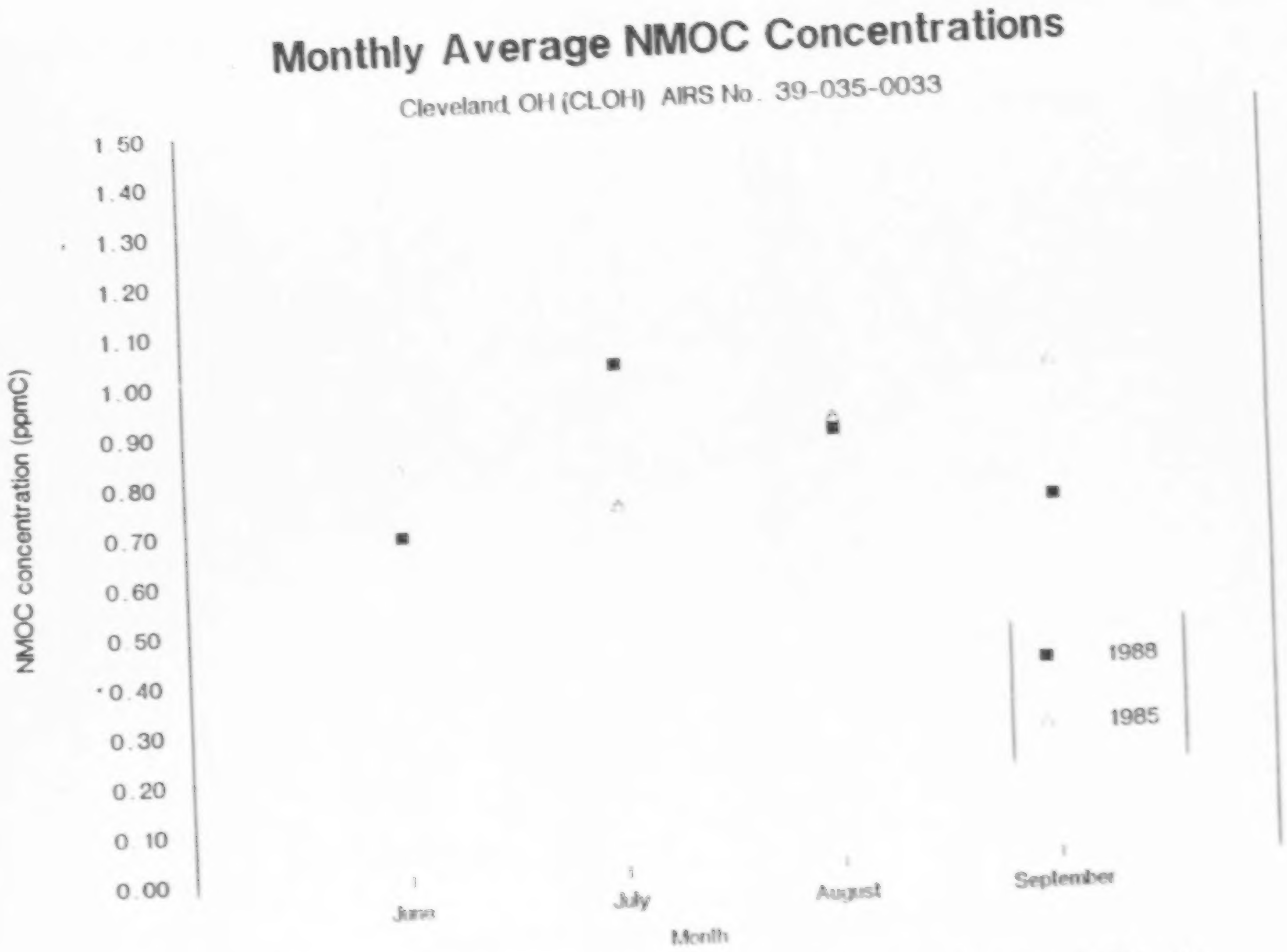

Figure 5-23. Monthly average NMOC concentrations for Cleveland, OH site.

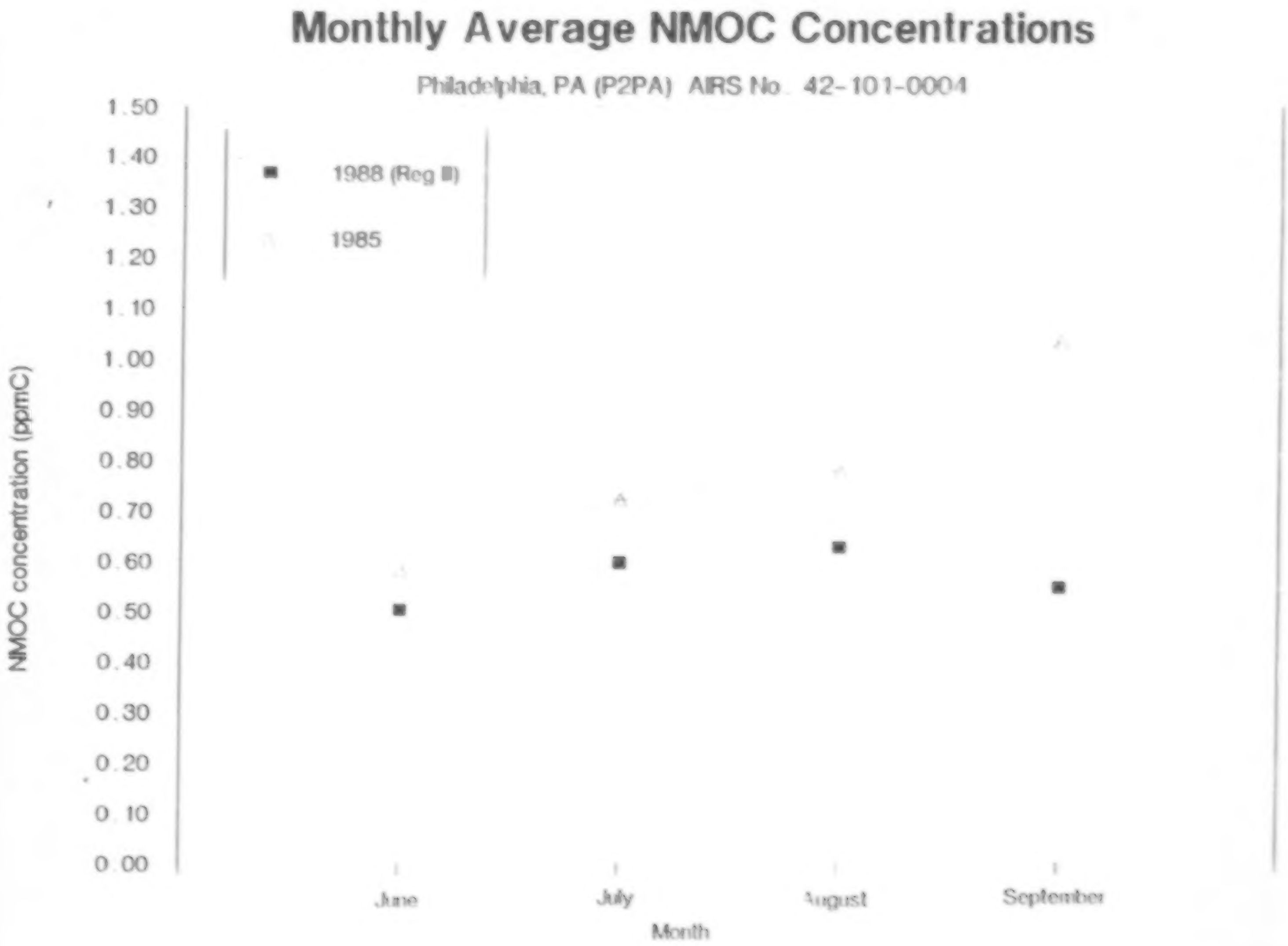

Figure 5-24. Monthly average NMOC concentrations for second Philadelphia, PA site.

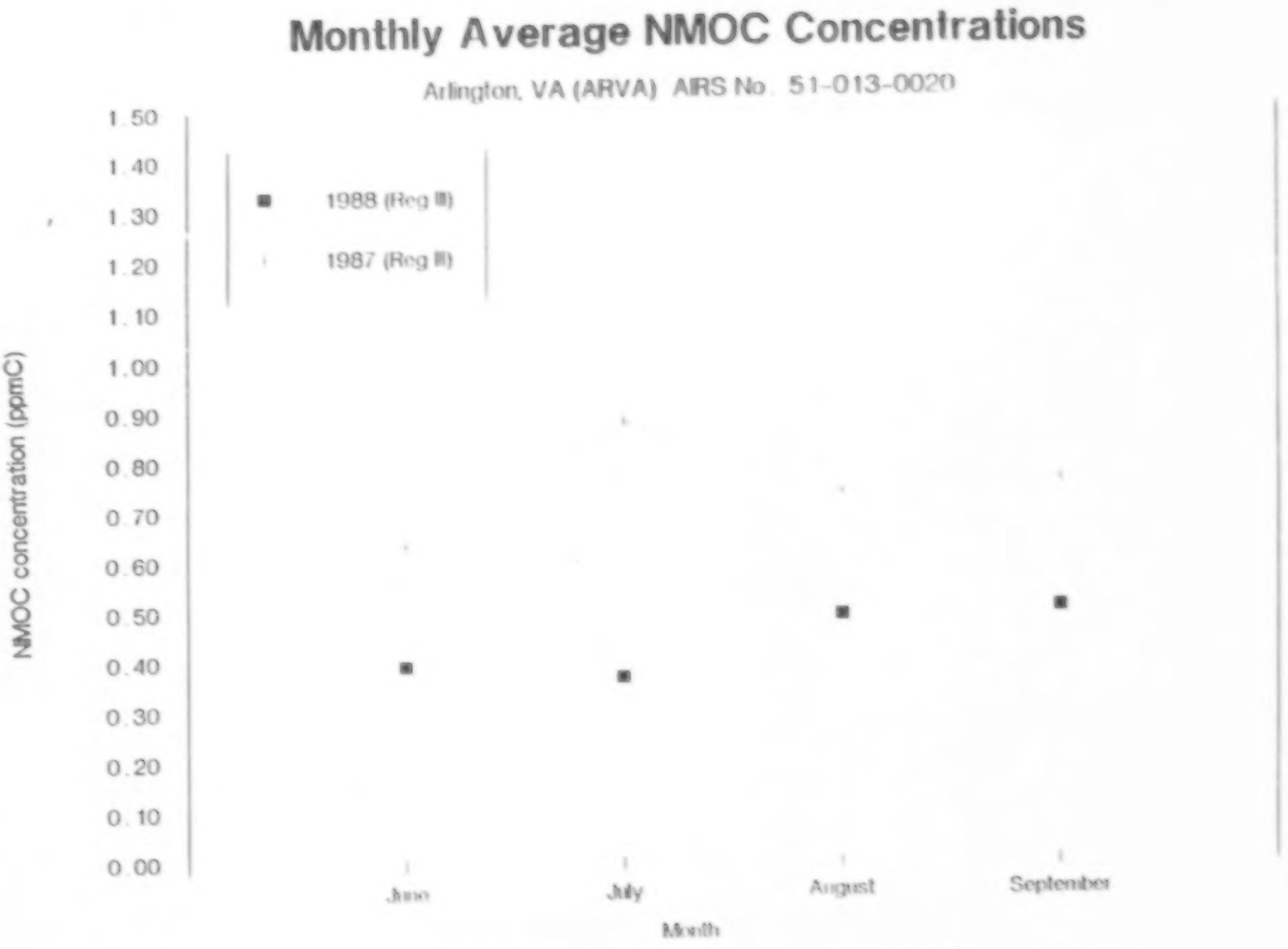

Figure 5-25. Monthly average NMOC concentrations for Arlington, VA site.

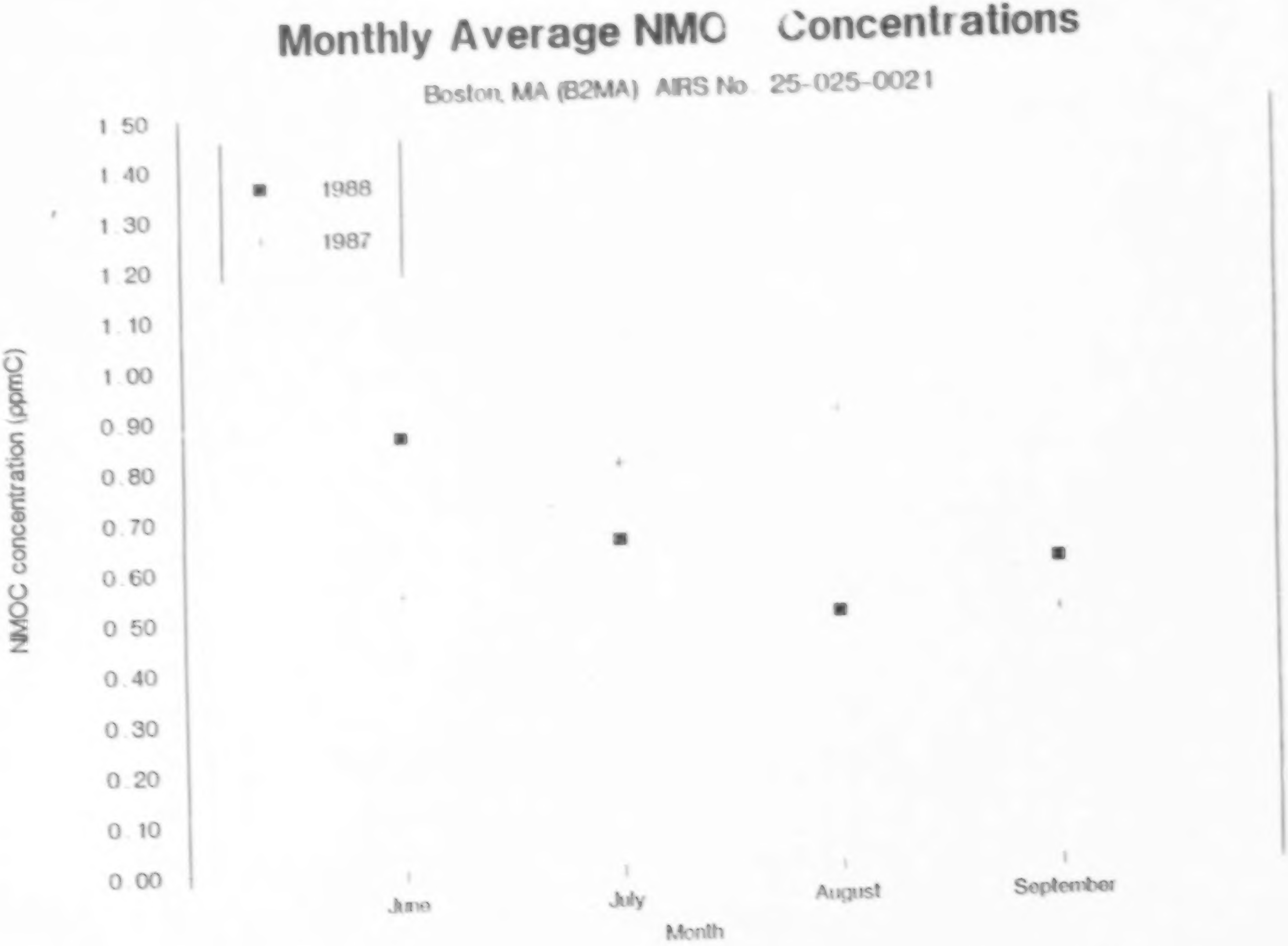

Figure 5-26. Monthly average NMOC concentrations for Boston, MA site.

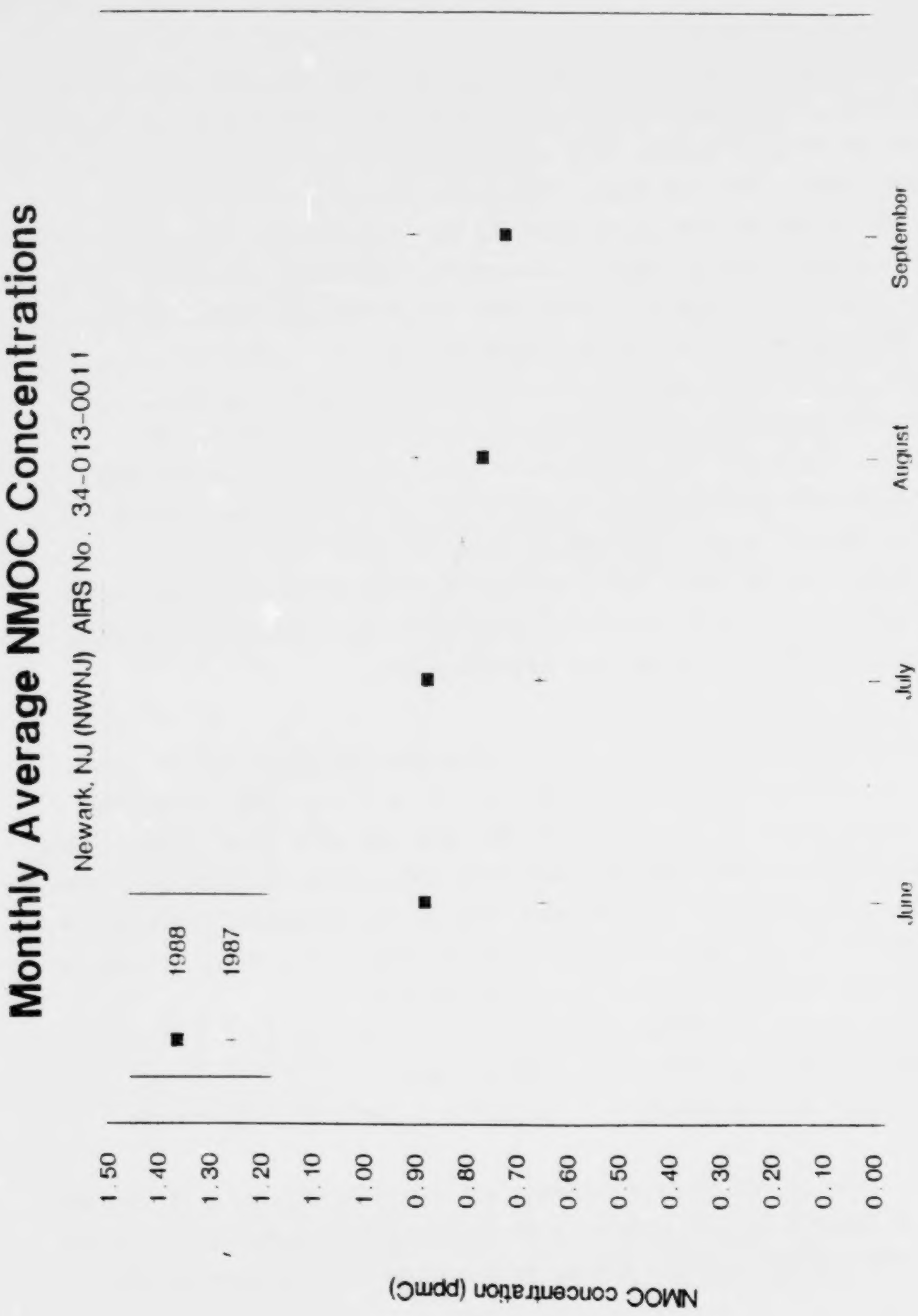

Figure 5-27. Monthly average NMOC concentrations for Newark, NJ site.

Comparing the 1985 results with the 1988 results emphasizes the strongly site-specific nature of the data.

The 1986 and 1987 data show virtually random behavior with respect to the 1988 data. These observations are summarized in Table 5-3, which shows a comparison of monthly average NMOC concentrations between 1988 and comparison years 1984, 1985, 1986, and 1987. Table 5-3 shows the number of months in 1988 for which the corresponding month in the comparison year showed a higher (or lower) monthly average NMOC concentration. The final column in Table 5-3 shows the probability that y or fewer months in 1988 had higher average monthly NMOC concentrations in the comparison year by random processes. It shows that in 1984, the four (or fewer) lower monthly average NMOC concentrations could not have occurred at random, with a 99.99903% probability. Similarly the fact that in 1985, the monthly average NMOC concentration occurred 5 (or fewer) times out of 37 comparisons could not have happened at random, with a 99.999987% probability.

Comparing 1986 data with 1988 and 1987 data with 1988 shows about an equal probability, so that no trends are readily apparent among the 1986, 1987, and 1988 monthly average NMOC concentrations.

5.3.2 Task 2

The purpose of this task was to correlate the daily maximum ozone concentration at a receptor site to the 6 a.m. to 9 a.m. NMOC integrated average concentration at a source site for June and July 1988. NMOC source and ozone receptor sites used for this study are listed in Table 5-4. Maximum daily ozone concentrations in ppmv were used as the dependent variable, while NMOC concentration in ppmC (and/or its square, and/or its cube) was used as the independent variable. Correlations tested were:

$$(O_3)_{max} = a_1 + b_1\,(NMOC), \tag{1}$$

$$(O_3)_{max} = a_2 + b_2\,(NMOC) + c_2\,(NMOC)^2, \text{ and} \tag{2}$$

$$(O_3)_{max} = a_3 + b_3\,(NMOC) + c_3\,(NMOC)^2 + d_3\,(NMOC)^3. \tag{3}$$

The results of the data analysis are given in Figures 5-28 through 5-35 and in Table 5-5. The figures plot daily maximum ozone concentration (ppmv) as the ordinate and the 6 a.m. to 9 a.m. integrated average NMOC

TABLE 5-3. COMPARISON OF MONTHLY AVERAGE NMOC CONCENTRATIONS

Comparison Year	No. Months in 1988 < Corresponding Month in Comparison year, x	No. Months in 1988 > Corresponding Month in Comparison year, y	n= x+y	$P(z \leq y)$[a]
1984	28	4	32	9.651×10^{-6}
1985	34	5	39	1.215×10^{-6}
1986	13	16	29	0.7709
1987	25	23	48	0.4427

[a] $P(z \leq y)$ is the probability that y (or fewer) cases could occur by random processes.

$P(y) = \binom{n}{y} p^y q^{n-y}$, the binominal probability that y occurred out of n cases. Quantities p and q for the comparisons made in this study equal 0.5.

TABLE 5-4. SITES FOR JUNE AND JULY 1988 OZONE-NMOC CORRELATION

NMOC Site Code	NMOC Site Location	Modeled Ozone Receptor Site	Receptor Site AIRS Number
C6IL	Chicago, IL	Evanston, IL	17-031-7002
		Waukegan, IL	17-097-1002
H1TX	Houston, TX (Mae Drive)	Aldine, TX	48-201-0024
		NW Harris Co.	48-201-0029
		Mae Drive	48-201-1034
MNY	New York, NY (Mable Dean)	Greenwich, CT	09-001-0017
		Bayonne, NJ	34-017-0006
		Mable Dean	36-061-0010
NWNJ	Newark, NJ	Bayonne, NJ	34-017-0006
		Plainfield, NJ	34-035-1001
		Newark, NJ	34-013-0011
PLNJ	Plainfield, NJ	Bayonne, NJ	34-017-0006
		Newark, NJ	34-013-0011
		Plainfield, NJ	34-035-1001
PLNJ & NWNJ & MNY[a]	Plainfield, NJ, Newark, NJ, and New York, NY	Greenwich, CT	09-001-0017
		Bayonne, NJ	34-017-0006
NWNJ & PLNJ[b]	Newark and Plainfield, NJ	Bayonne, NJ	34-017-0006

[a] NMOC daily concentrations are averaged for Plainfield, Newark, and New York.

[b] NMOC daily concentrations are averaged for Newark and Plainfield, NJ.

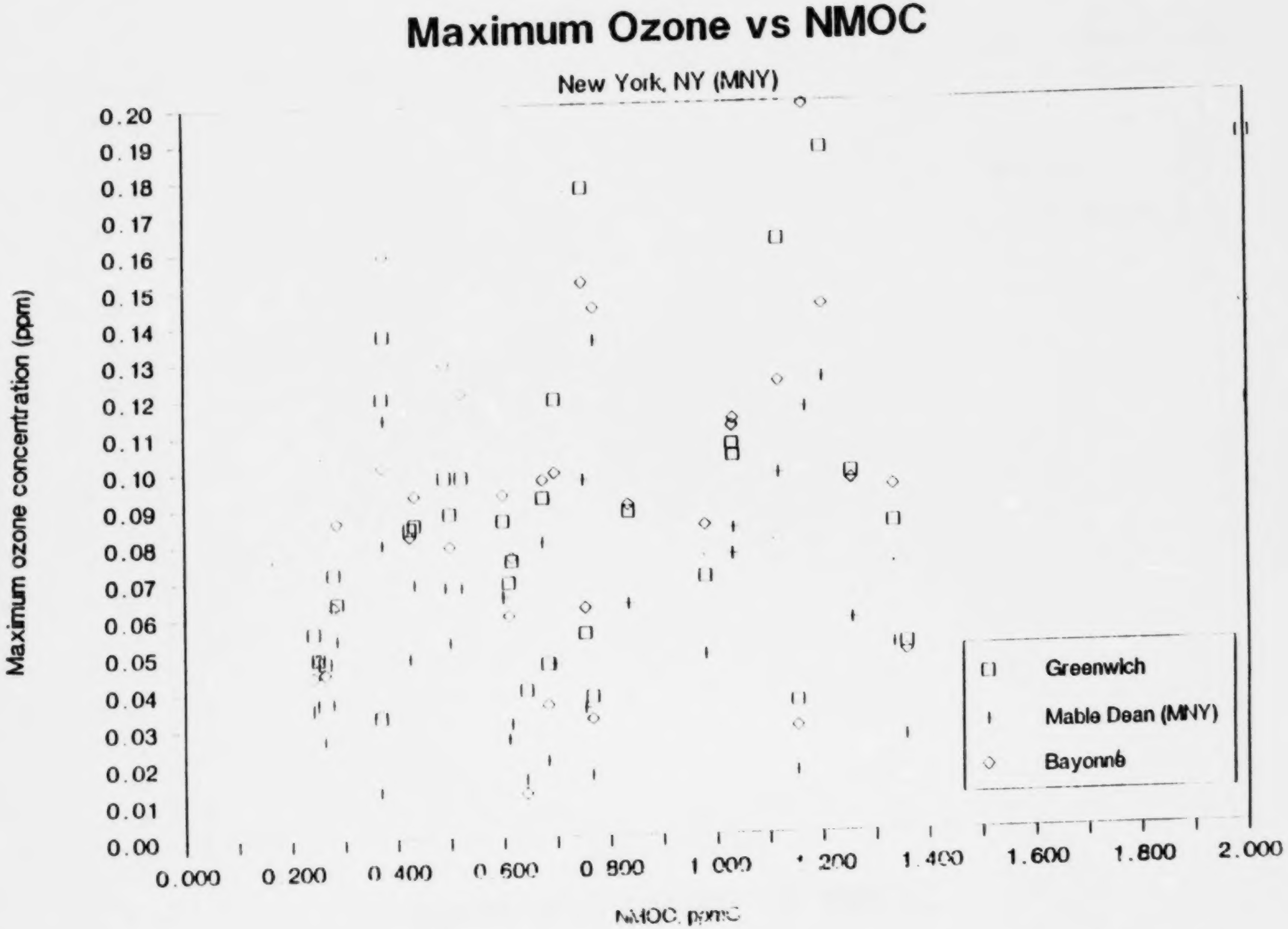

Figure 5-28. Maximum ozone versus NMOC concentration for New York, NY site.

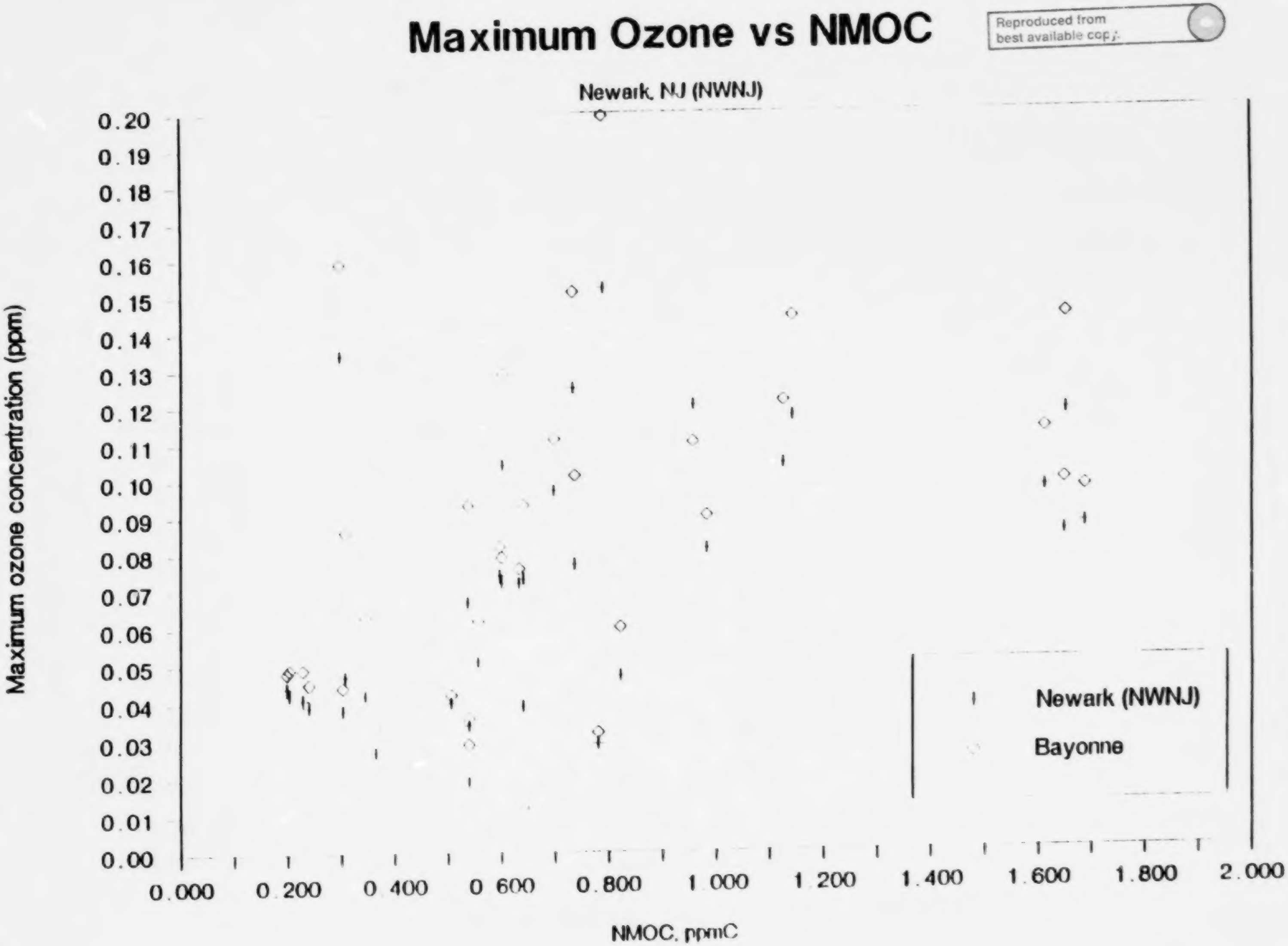

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Figure 5-29. Maximum ozone versus NMOC concentration for Newark, NJ site.

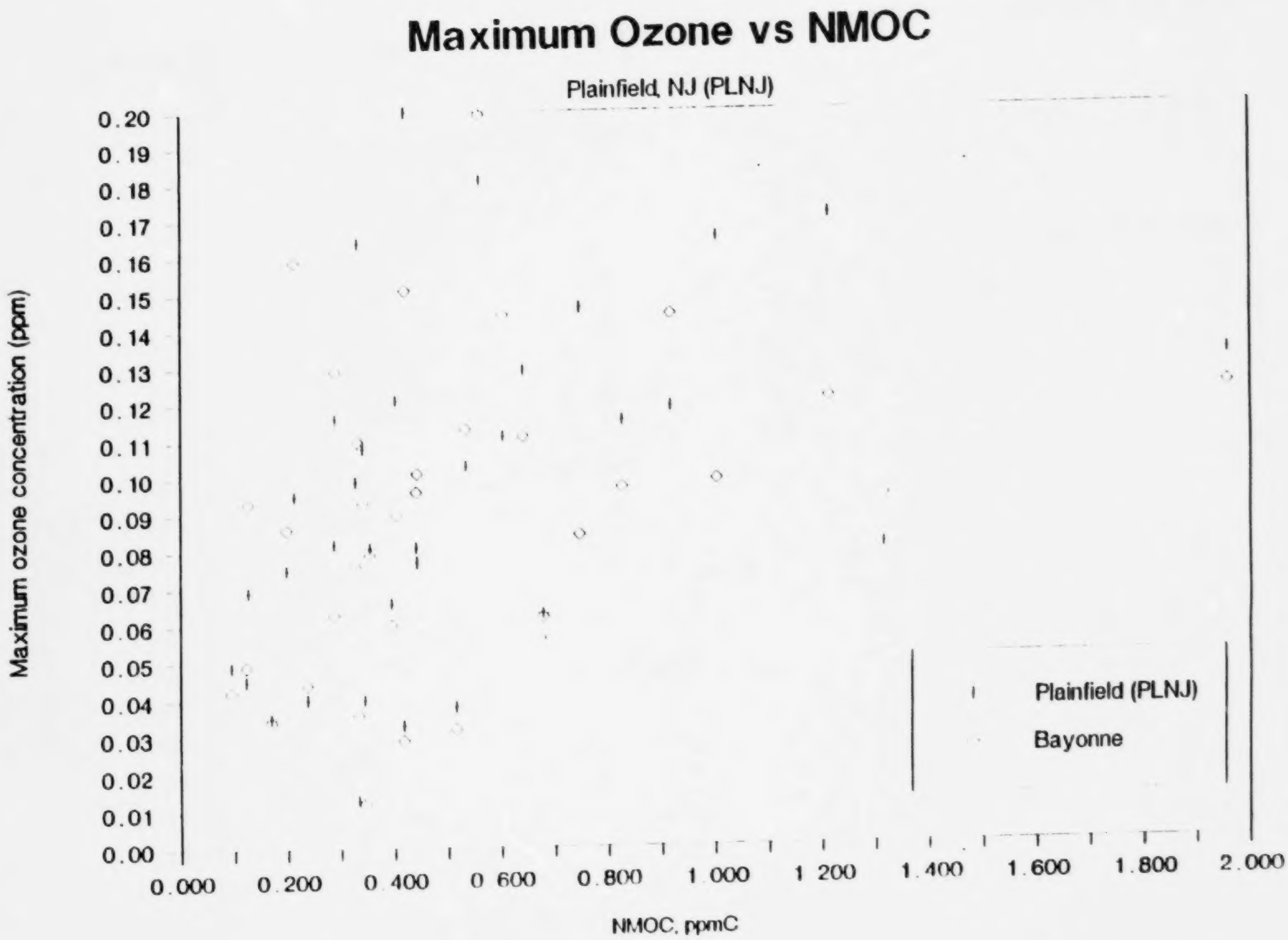

Figure 5-30. Maximum ozone versus NMOC concentration for Plainfield, NJ site.

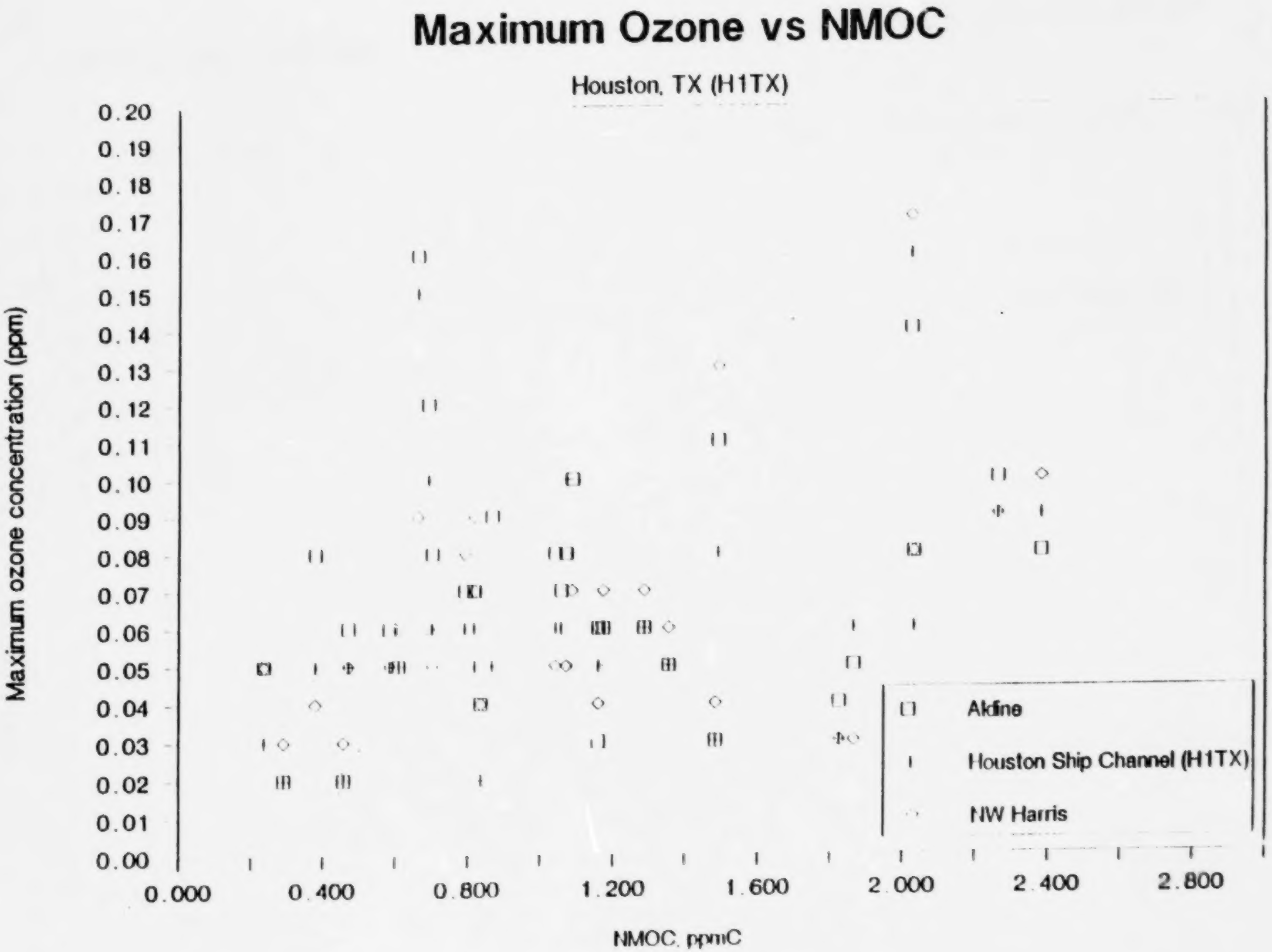

Figure 5-31. Maximum ozone versus NMOC concentration for Houston, TX site.

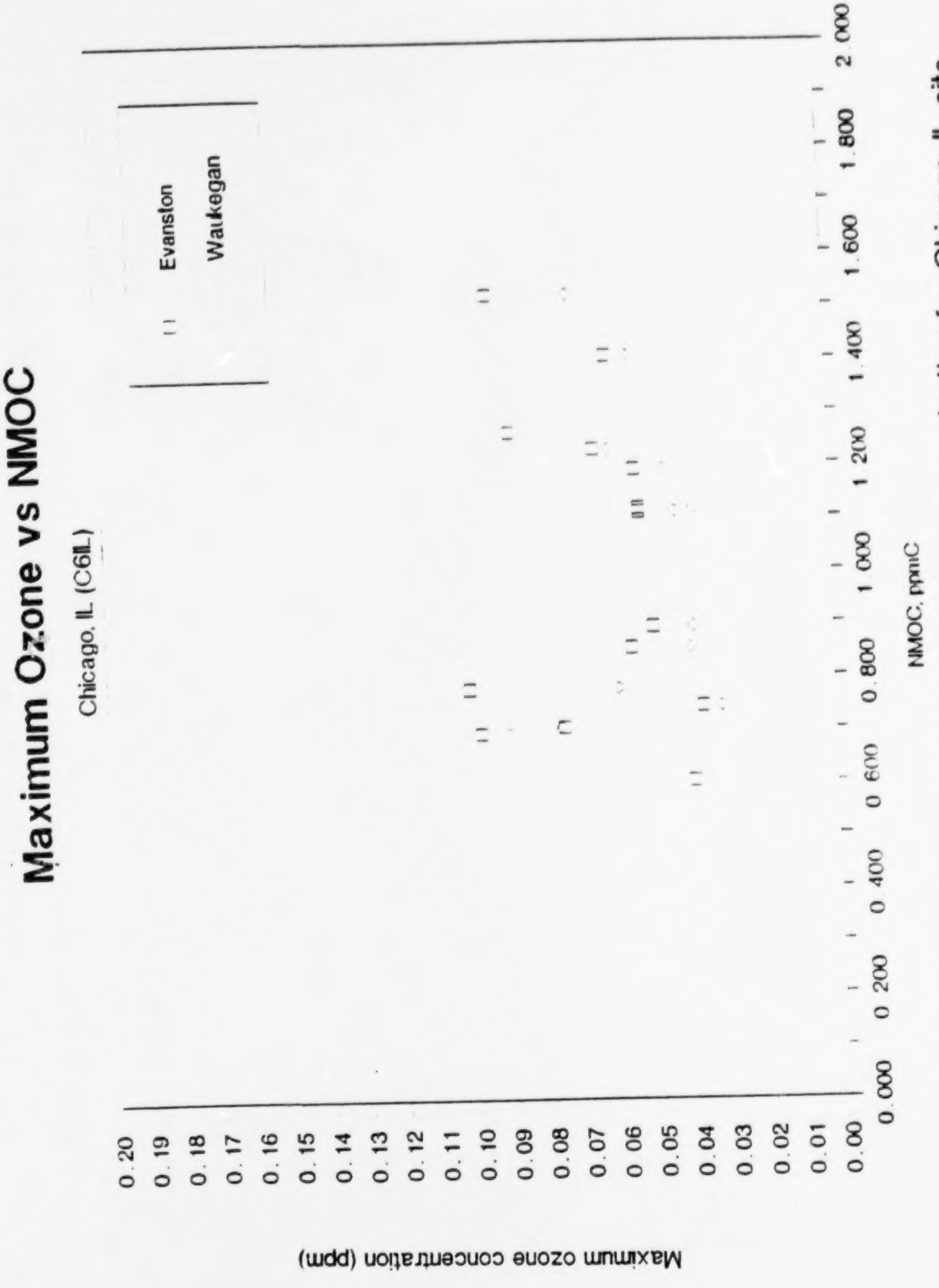

Figure 5-32. Maximum ozone versus NMOC concentration for Chicago, IL site.

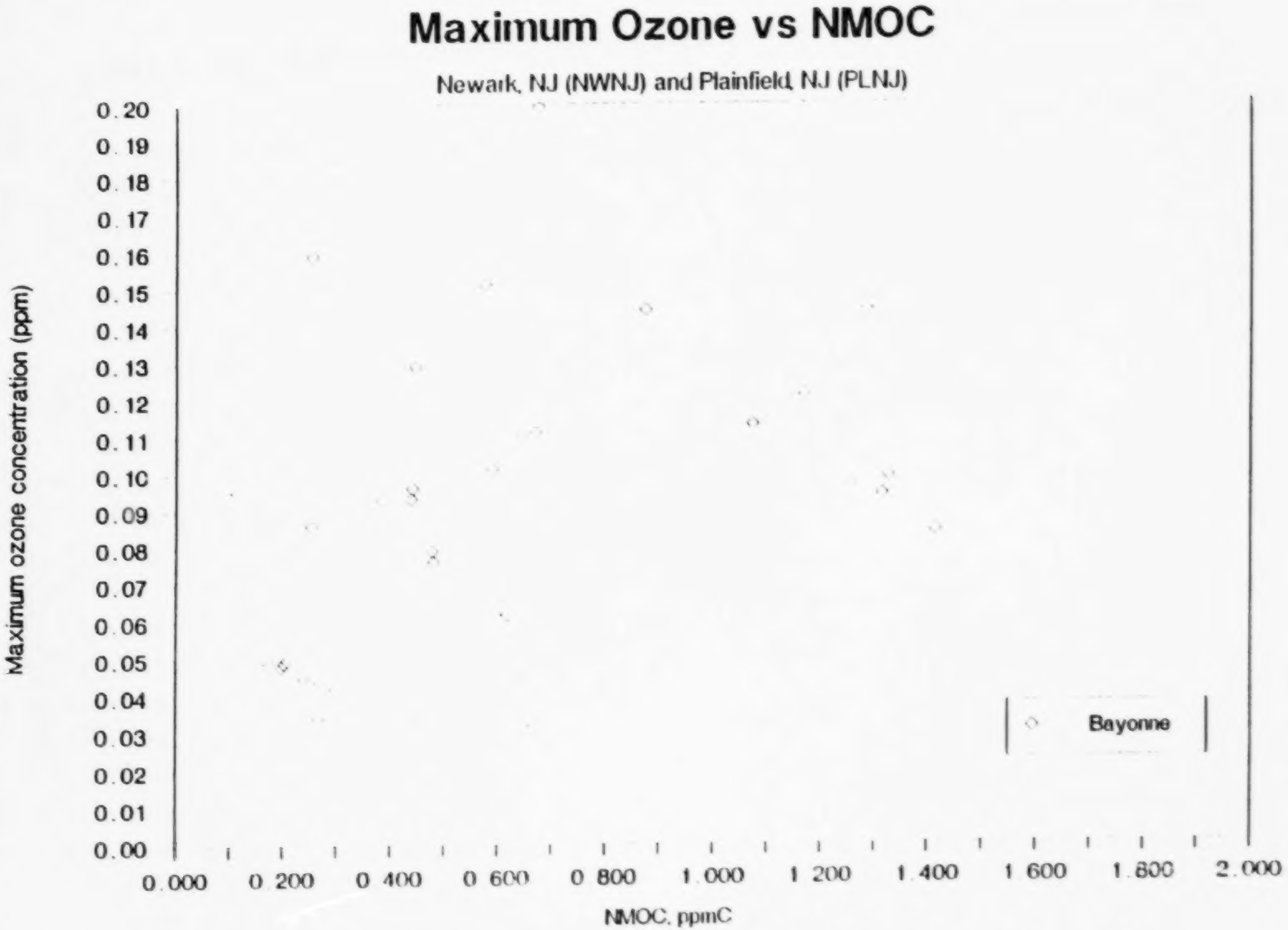

Figure 5-33. Maximum ozone vs NMOC concentration for Newark, NJ and Plainfield, NJ site.

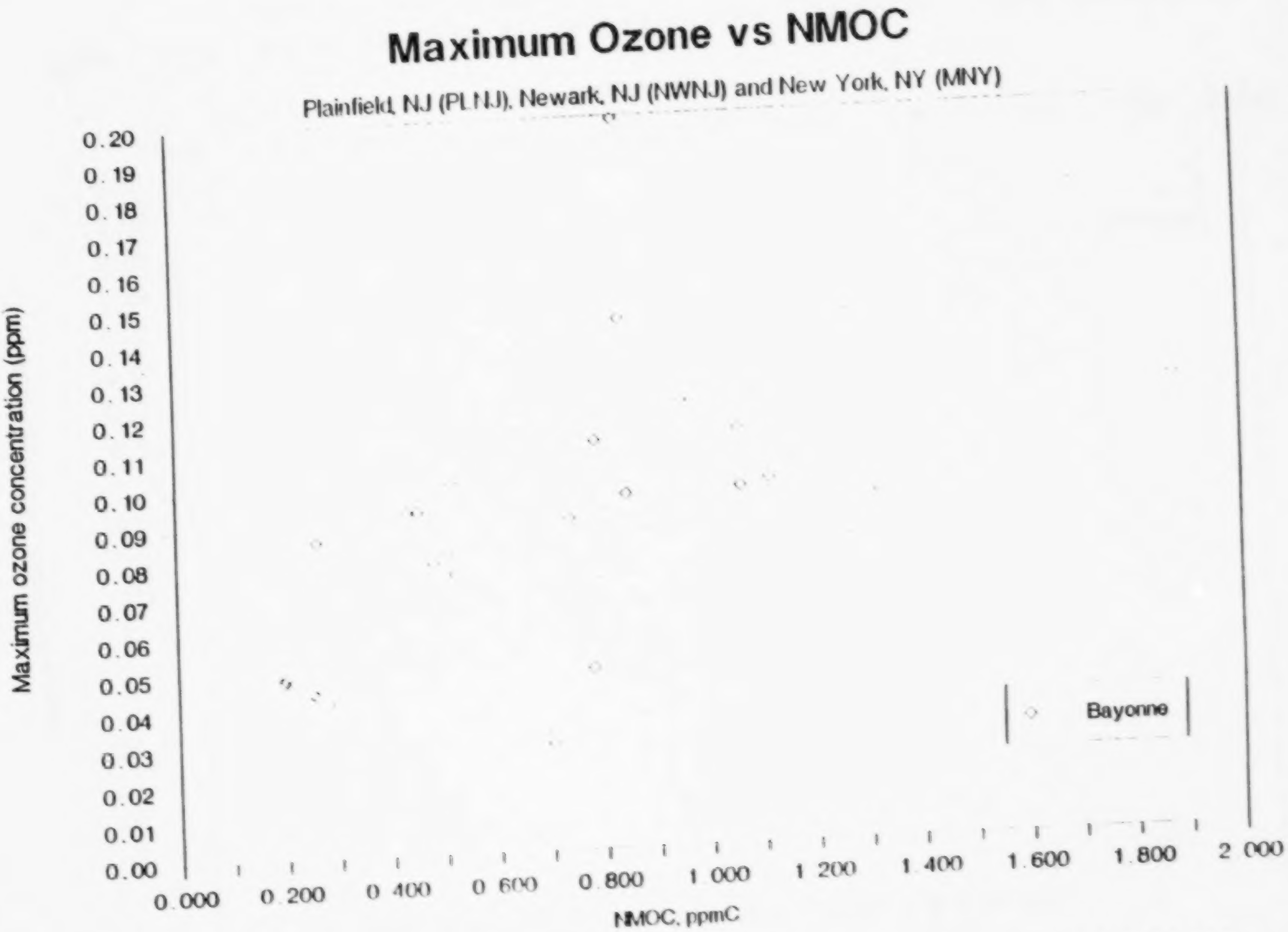

Figure 5-34. Maximum ozone versus NMOC concentraton for pooled Plainfield, NJ. Newark, NJ and New York, NY site.

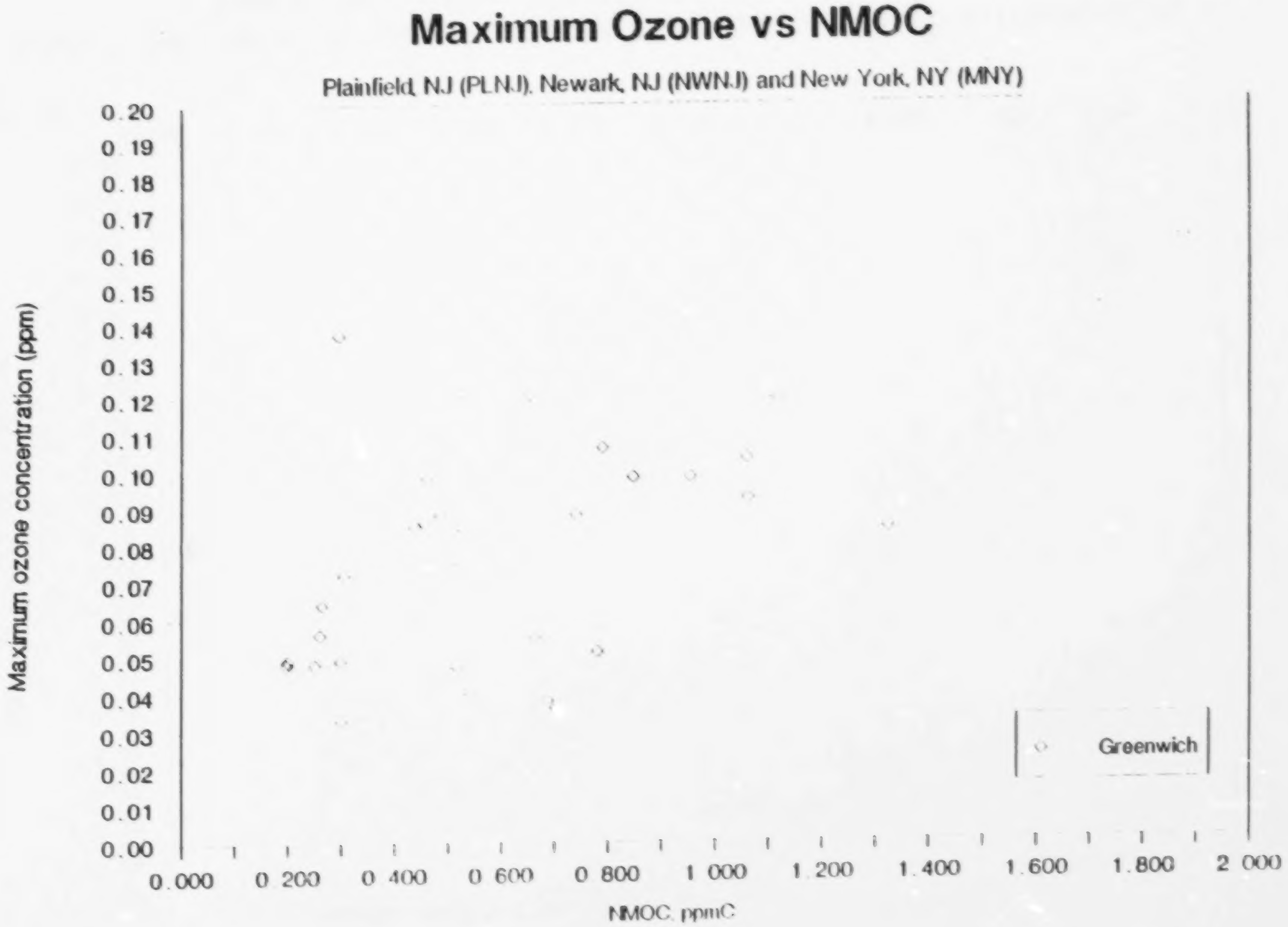

Figure 5-35. Maximum ozone versus NMOC concentration for pooled Plainfield, NJ, Newark, NJ and New York, NY site.

TABLE 5-5. MAXIMUM OZONE vs. NMOC CORRELATIONS

NMOC Source Site	Receptor Site for Ozone Maximum	Cases	Regression Coefficients a	b	c	d	P(a=0.0)	P(b=0.0)	P(c=0.0)	P(d=0.0)	Coefficient of Regression R
C6IL	Evanston, IL	14	0.05305	0.01186	-	-	0.03150	0.57966	-	-	0.162
		14	0.13456	-0.15719	0.08117	-	0.16223	0.40585	0.36947	-	0.313
		14	-0.19970	0.86386	-0.90903	0.30699	0.60348	0.45779	0.41698	0.37658	0.411
	Waukegan, IL	16	0.02231	0.02884	-	-	0.10245	0.04239	-	-	0.512
		16	0.00684	0.07714	-0.02949	-	0.71046	0.09234	0.25435	-	0.579
		16	-0.00056	0.19796	-0.24526	0.09598	0.97548	0.04431	0.10948	0.14898	0.667
H1TX	Aldine, TX	33	0.05093	0.01657	-	-	0.00015	0.09759	-	-	0.293
		33	0.03732	0.04644	-0.01225	-	0.07078	0.21315	0.40266	-	0.328
		33	0.00090	0.20954	-0.18433	0.04849	0.97138	0.01425	0.02479	0.03260	0.489
	NW Harris Co	32	0.03379	0.02679	-	-	0.00208	0.00282	-	-	0.511
		32	0.02784	0.03998	-0.00541	-	0.11450	0.21618	0.66854	-	0.515
		32	0.00482	0.14306	-0.11410	0.03061	0.82863	0.05567	0.11079	0.12227	0.572
	H1TX	33	0.03560	0.02331	-	-	0.00298	0.01550	-	-	0.418
		33	0.02674	0.04275	-0.00797	-	0.16530	0.02245	0.56218	-	0.429
		33	-0.00327	0.17717	-0.14979	0.03996	0.89177	0.02955	0.05528	0.06473	0.525
MNY	Greenwich, CT	36	0.05025	0.05789	-	-	0.00165	0.00241	-	-	0.490
		36	0.04505	0.07337	-0.00868	-	0.06568	0.21134	0.77893	-	0.492
		36	0.00674	0.26511	-0.24445	0.07829	0.84292	0.05837	0.12196	0.12805	0.544
	Bayonne, NJ	36	0.06377	0.03446	-	-	0.00012	0.05611	-	-	0.321
		36	0.06189	0.03960	-0.00276	-	0.02523	0.52889	0.93183	-	0.322
		36	0.03487	0.15293	-0.12913	0.03945	0.50855	0.44628	0.54717	0.55109	0.337
	MNY	37	0.03406	0.03318	-	-	0.00368	0.01649	-	-	0.392
		37	0.03117	0.04169	-0.00478	-	0.08592	0.33483	0.83460	-	0.393
		37	0.00821	0.15661	-0.14643	0.04712	0.74858	0.13185	0.21476	0.22100	0.439
NWNJ	Bayonne, NJ	38	0.05802	0.03213	-	-	0.00000	0.00231	-	-	0.480
		38	0.03688	0.08213	-0.01824	-	0.02972	0.01311	0.10372	-	0.536
		38	0.01466	0.16820	-0.09504	0.01747	0.52336	0.02122	0.10260	0.17634	0.570
	Plainfield, NJ	38	0.05453	0.04244	-	-	0.00001	0.00017	-	-	0.573
		38	0.01953	0.12525	-0.03021	-	0.22187	0.00021	0.00697	-	0.676
		38	0.00353	0.18724	-0.08551	0.01258	0.87472	0.00940	0.13153	0.31583	0.687
	NWNJ	38	0.04680	0.03013	-	-	0.00000	0.00044	-	-	0.542
		38	0.02960	0.07084	0.01485	-	0.02787	0.00738	0.09502	-	0.591
		38	0.00696	0.15852	-0.09309	0.01780	0.69638	0.00607	0.04210	0.07941	0.637

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TABLE 5-5. (Continued)

NMOC Source Site	Receptor Site for Ozone Maximum	Cases	Regression Coefficients a	b	c	d	P(a=0.0)	P(b=0.0)	P(c=0.0)	P(d=0.0)	Coefficient of Regression R
PLNJ	Bayonne, NJ	36	0.06674	0.04001	-	-	0.00000	0.01113	-	-	0.418
		36	0.04883	0.10251	-0.03201	-	0.00673	0.04106	0.18262	-	0.468
		36	0.02730	0.23378	-0.21285	0.06086	0.26138	0.04913	0.15171	0.21530	0.506
	Newark, NJ	36	0.05458	0.03576	-	-	0.00000	0.00607	-	-	0.449
		36	0.04344	0.07462	-0.01990	-	0.00349	0.07106	0.31513	-	0.475
		36	0.01896	0.22390	-0.22555	0.06921	0.33508	0.02167	0.06409	0.08597	0.543
	PLNJ	36	0.06675	0.04926	-	-	0.00000	0.00385	-	-	0.470
		36	0.03597	0.15666	-0.05501	-	0.04386	0.00301	0.02783	-	0.573
		36	0.01848	0.26332	-0.20195	0.04945	0.45601	0.03174	0.18382	0.32412	0.591
PL & NW & H[a]	Greenwich, CT	39	0.04581	0.06090	-	-	0.00022	0.00006	-	-	0.598
		39	0.03924	0.07893	-0.00852	-	0.03476	0.05821	0.63801	-	0.602
		39	0.01997	0.17126	-0.11411	0.03066	0.45034	0.09541	0.28947	0.31951	0.616
	Bayonne, NJ	39	0.05849	0.04085	-	-	0.00001	0.00478	-	-	0.443
		39	0.04524	0.07505	0.01569	-	0.02676	0.08981	0.40768	-	0.460
		39	0.03543	0.11648	-0.06002	0.01243	0.31148	0.36511	0.64457	0.73030	0.463
NW & PL[b]	Bayonne, NJ	39	0.06325	0.03484	-	-	0.00000	0.00473	-	-	0.443
		39	0.04688	0.07841	-0.01841	-	0.00901	0.04668	0.23756	-	0.477
		39	0.01975	0.19923	-0.13367	0.03012	0.51867	0.09503	0.22333	0.28758	0.502

[a] Average of Newark, Plainfield, and New York NMOC concentrations for June and July 1988.

[b] Average of Newark and Plainfield, NJ NMOC concentrations for June and July 1988.

concentration in ppmC as the abscissa. For Figures 5-33, 5-34, and 5-35, the daily average NMOC concentrations were averaged for the NMOC source sites shown. Table 5-5 lists the correlation statistics for equations (1), (2), and (3) for the various site combinations shown. NMOC source sites are symbolized in the first column. The second column shows the ozone receptor sites tested. Column 3 gives the number of days in June and July 1988 for which both ozone and NMOC data were available. The next four columns give the regression coefficients for equations (1), (2), and (3).

The first row in Table 5-5 (C6IL vs. Evanston, IL) gives a and b for equation 1; the second row, a, b, and c for equation 2; and the third row, a, b, c, and d for equation 3. Columns 8 through 11 give probabilities that the constants indicated are zero, i.e., in the first row P(a=0.0) = 0.03150 indicates that the probability that a is zero equals 0.03150; and P(b=0.0) = 0.57966 indicates that the probability that b is zero equals 0.57966. A regression coefficient is taken to be "significant" (i.e., significantly different from zero), if the probabilities are equal to or less than 0.05.

For the correlation (between ozone and NMOC) to be significant, a, b, c, or d needs to be different from zero. Therefore, for the Chicago-Evanston data, the first three rows in Table 5-5, none of the correlations is significant. On the other hand, there is a good linear correlation between ozone and NMOC concentrations for the MNY-Greenwich, CT, site pair [P(a=0.0) = 0.00165, and P(b=0.0) = 0.00241].

The final column in Table 5-5 gives the coefficient of regression, R, for each combination tested. The values of R range from 0.162 to 0.687. Even for the MNY-Greenwich, CT, data pair cited above, the correlation coefficient for the linear regression is only 0.490, despite the significance of the regression coefficients a and b. This information emphasizes the fact that NMOC alone explains only about 49% of the variation of maximum ozone with NMOC concentration. This fact implies that other independent variables, in addition to NMOC concentration, are required adequately to predict ozone concentrations--possibly parameters involving NO_x concentration, meteorological data, temperature, and/or radiation intensity.

The data for the Chicago, Illinois, NMOC source site (C6IL) for June and July 1988 are spotty and do not follow the pattern evident in the remaining sites. The pattern shows that in virtually all other combinations tested, a significant linear relationship exists between maximum ozone concentration at a receptor site (or a NMOC source site) and NMOC concentration at a source site. Quadratic and cubic relations (equations 2 and 3) do not show significant correlations. As explained above, significant relationships are obtained where the probabilities that the regression coefficients, a, b, c, and/or d are equal to or less than 0.05.

Conclusions reached in Task 2 are:

- The C6IL NMOC source data for June and July 1988 are not useful in this study because of the limited data;
- A linear relationship exists between daily maximum ozone concentration and 6 a.m. to 9 a.m. NMOC ambient air concentration for the sites studied in June and July 1988; and
- No significant quadratic or cubic trend exists between daily maximum ozone concentration and 6 a.m. to 9 a.m. NMOC concentration for the sites studied using the June and July 1988 monitoring data.

5.3.3 Task 3

The purpose of this task was to investigate whether canister age affected the measured NMOC concentration. If such a correlation could be discerned, it would then be possible to correct the measured NMOC concentration to remove the canister age effect, and, in turn, to improve the correlation between maximum ozone at a receptor site and the NMOC concentration at an urban site.

To explore the effect of canister age on measured NMOC concentration, the 1988 duplicate sample NMOC concentration results were used. For each duplicate sample, a difference in the measured NMOC concentration from samples taken from each canister was paired with the difference between the ages of the duplicate canisters. If canister age affected the measured NMOC concentration significantly, a plot of NMOC concentration difference (or percent difference) between duplicate would show a trend when plotted versus the paired differences in canister age for the duplicate canisters.

Figure 5-36 shows a plot of NMOC percent difference versus canister age for the 1988 duplicate sample canisters. The age difference is shown to be positive and negative indicating that the age difference was calculated by

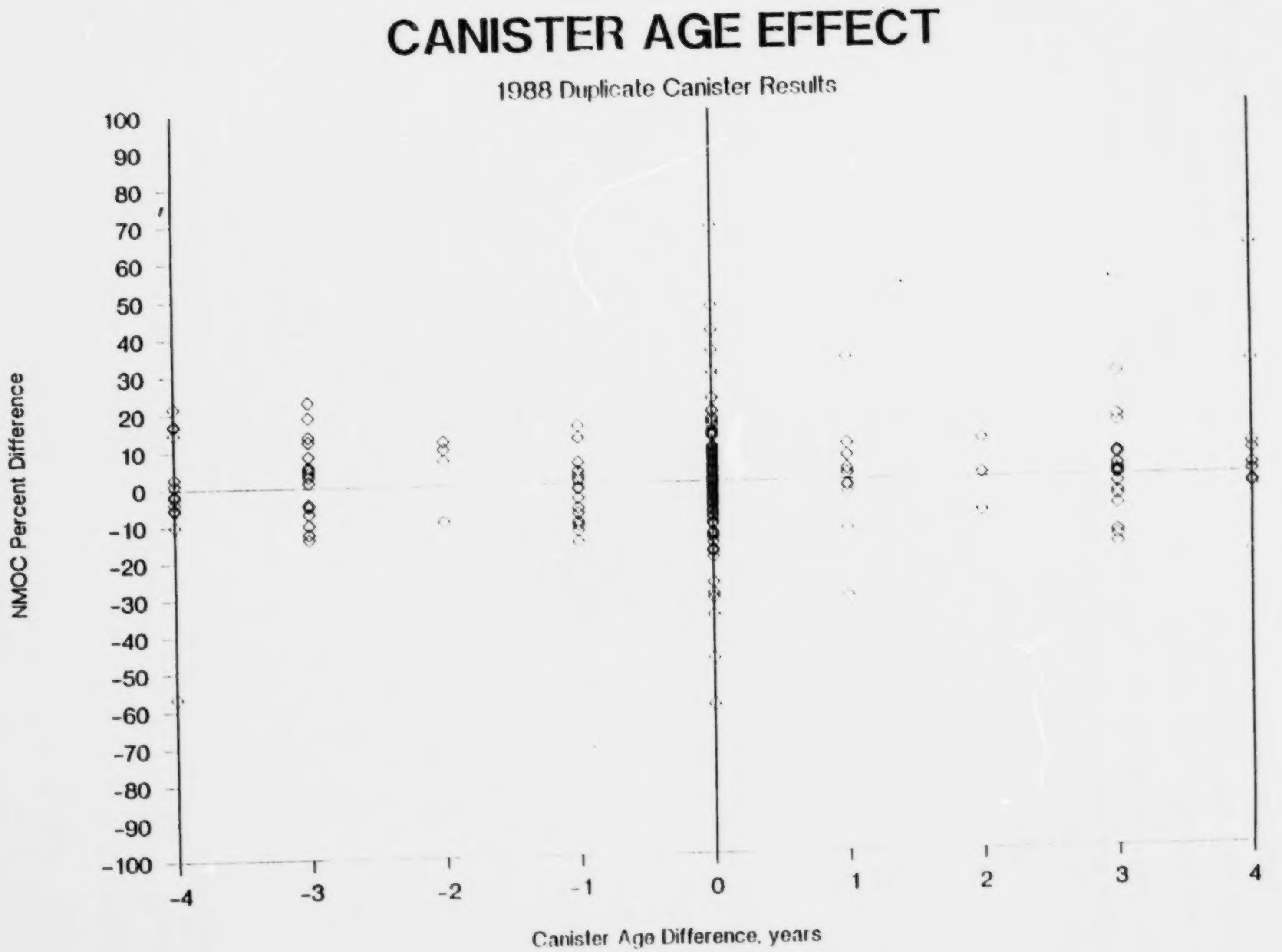

Figure 5-36. Percent NMOC as a function of canister age difference, by chronological analysis number.

chronological analysis number rather than by canister age. The same data were replotted in Figure 5-37 using for canister age difference the older canister age minus the younger canister age. The NMOC % difference was calculated in the same "direction" as the canister age.

Both these plots show that there is no significant correlation between measured NMOC concentration difference and canister age difference. These data implies that the internal surfaces of the SUMMA®-treated canisters remains passivated for at least four years, and probably longer when the canisters are used for ambient air samples.

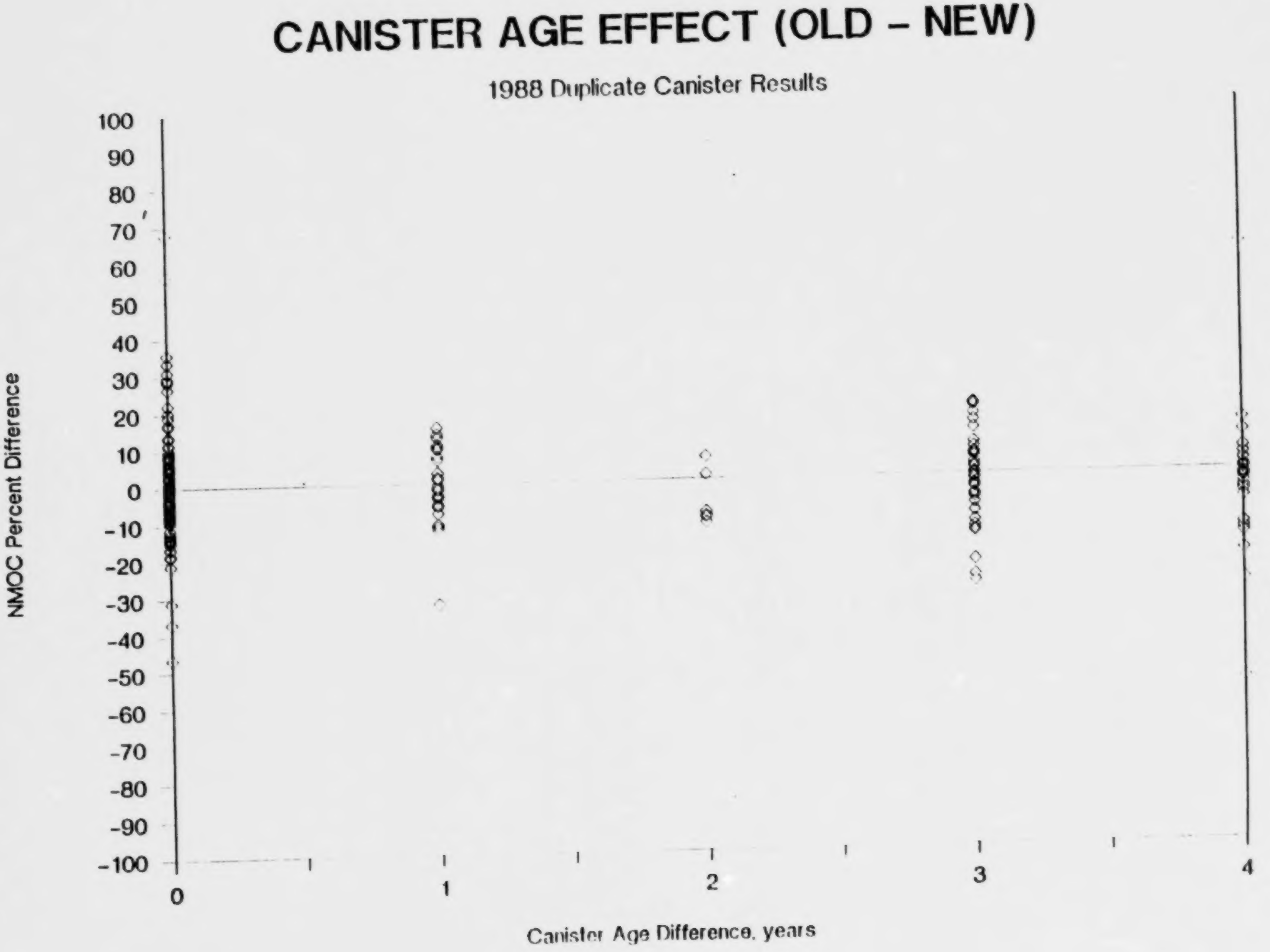

Figure 5-37. Percent NMOC as a function of canister age difference, by canister age.

6.0 RECOMMENDATIONS, NMOC MONITORING PROGRAM

Based on the experiences and results of the 1989 NMOC Monitoring Study, certain recommendations can be made with respect to equipment design and validation procedures.

6.1 OPERATING PROCEDURE CHANGES

Current operating procedures call for the use of dry propane standards and external audit samples. The experimental design recommended would cover the present NMOC span of 0 to 9 ppmC, and at least 3 levels of humidity: zero, low (~10%), and medium (~30%) relative humidity. The effect of humidity on propane calibration (and audit) results is currently unknown and should be determined.

6.2 VERTICAL STRATIFICATION STUDY

In 1987, 1988, and 1989 ambient air samples were taken at ground level (3 to 10 meters) and at the 1197-foot (364.9 meter) level. In 1988, an additional site was located on top of the World Trade Center in New York, a height of over 1000 ft. It is recommended that the study be continued at these sampling locations and that at least one more level (at 100 meters or some other appropriate height above ground level) be sampled at the same location. At the same time, barometric pressure and wind velocity and direction data should be obtained at each sampling level. These samples should be analyzed for NMOC content as well as for the air toxics compound concentrations. The information gained from such a study would be useful in validating various atmospheric model predictions.

6.3 SEASONAL NMOC STUDIES

Data derived in a study qualifying NMOC and NO_x in seasons other than summer could be useful in understanding the relationship of NMOC to NO_x and meteorological conditions. Currently a year-round study for 24-hour air toxics ambient air samples is being conducted. No study is currently in progress to determine seasonal NMOC concentration changes.

6.4 DIURNAL STUDIES

It is proposed that a diurnal study be made at an appropriate monitoring site to measure NMOC concentrations 24-hours per day, seven days per week, for at least four weeks. An appropriate site for such a study would be one at which the NMOC concentration averaged 0.800 ppmC or greater, and one at which meterological as well as NO_x data were available. Sampling plans could include both continuous NMOC measurement, and collection of integrated samples at various times through the day.

6.5 CANISTER CLEANUP STUDIES

Additional cleanup studies are proposed to determine more specifically the carryover of organic material after cleaning, and to determine how storage of cleaned, evacuated canisters affects NMOC concentration of a sample. Storage effects up to three months under vacuum and under pressure should be included in the study.

Additional studies are proposed to compare cleanup procedures at room temperature with cleanup procedures involving heating of the canisters.

After July 14, 1988, the canister procedure was revised to eliminate steps 4 and 5. If in Step 6 for either of the cleanup procedures the NMOC concentration was greater than 0.030 ppmC, the cleaning procedure was repeated until the acceptance criterion was met.

Radian has proposed[7] initiation of several studies to determine whether the present canister cleanup procedure is adequate to prevent significant carryover of organic compounds from one canister to the next. These studies are needed since equilibration in a canister may take a week or longer.

The effect of sample pressure on the measured NMOC concentration is not clear. Ambient air samples are sufficiently humid so that at 15 psig, liquid water condenses inside the canister. Migration of liquid water to the canister walls affects the adsorption equilibrium, and at the same time, provides a medium for further depletion of the vapor phase organic compounds because of the solubility of the organics in water. Equilibration under these conditions would take longer, perhaps 30 days or more, and the effect on the measured air sample NMOC (and UATMP target compound) concentration has not been determined. These effects, however, are probably not significant for the NMOC measurements, but could affect 3-hour air toxics measurements.

Radian has proposed undertaking a study to ensure a better understanding and measurement of the effectiveness of the canister cleanup procedure. The present canister cleanup procedure appears to be adequate for the NMOC program, since the concentrations of interest are at the ppmC level. However, the 3-Hour Air Toxics and UATMP, the concentration levels are at the ppbv levels, i.e., 0.01 to 50 ppbv, and the present canister cleanup procedure may not be sufficient to prevent significant carryover of target compounds from one sample to the next.

6.6 COORDINATED SAMPLING AT NMOC SITES

It is recommended that where possible the following sampling take place at NMOC sites for the 1990 monitoring programs:

- NMOC samples;
- Aldehyde samples;
- 3-hour air toxics compounds; and
- UATMP sampling (at least 38 target compounds).

This kind of program would effect some economy in setting up and monitoring the sampling program, and also provide some opportunity for cross-correlation of the results.

Coordinated sampling would be most meaningful at sites where NMOC and/or UATMP monitoring occurred the previous year (or years).

6.7 FIELD AUDIT

It is recommended that a field audit be designed and conducted at several NMOC sites during the 1990 Monitoring Program. It is suggested that one field audit per month be performed at an NMOC site during June, July, August, and September 1989. The field audit should use at least one standard of known NMOC concentration and should collect duplicate samples plus a zero-air blank for each site.

6.8 DUPLICATE SAMPLE AND REPLICATE ANALYSIS

During the 1990 NMOC Monitoring Program records should be kept of (1) the NMOC concentration in a duplicate canister before cleanup, and (2) the zero-air NMOC concentration at the time of the third pressurization with clean, humidified zero air. The duplicate samples should be scheduled so that the same amount of time elapses between sampling and analysis for all duplicate samples.

7.0 THREE-HOUR AIR TOXICS DATA SUMMARY

The 1989 NMOC Program included three-hour air toxics samples at 7 NMOC urban sites (See Table 7-1) located in the contiguous United States. Overall concentration results are reported in parts per billion by volume (ppbv) in Section 7.1, and site-specific results are given in Section 7.2.

Analyses were done by a GC/MD system using flame ionization detection (FID), photoionization detection (PID), and electron capture detection (ECD). Compound identification was made using a combination of retention time, ratios of PID/FID and/or ECD/FID responses, and analyst experience and judgment. Quantitation was done using the FID response, with the exception of halogenated compounds that were quantitated using the ECD. If there was an indication that the quantitation detector response for the target compound had interference from an unknown source quantitation was performed on one of the alternate detectors if applicable. Table 7-1 indicates the number of 3-hour samples taken for GC/MD analyses to speciate for 38 UATMP compounds. About 11 analyses were performed on samples from each site. One duplicate sample was collected from each site, and the analysis of one of the samples from each site was replicated. Two of the samples from each site were analyzed by gas chromatography/mass spectrometry (GC/MS) for confirmation of compound identification.

Three-hour air toxics samples were regular NMOC Monitoring Program samples that were collected in 6-L stainless steel canisters from 6:00 a.m. to 9:00 a.m. The final canister pressure was about 12 psig. The NMOC samples that were speciated by GC/MD were selected at random during the summer. Each selected sample was first analyzed by the PDFID method for its NMOC concentration. Then the canister pressure was bled to atmospheric pressure and the canister bellows valve was closed. The canister was allowed to equilibrate at least 18 hours before the GC/MD analysis was performed.

7.1 OVERALL RESULTS

Concentrations of the air toxic compounds detected are summarized in Table 7-2 for the 1989 3-hour ambient air samples that were speciated. The table shows the number of cases (samples), the percent of cases in which the

TABLE 7-1. THREE-HOUR AMBIENT AIR SAMPLES AND ANALYSES

Site Code	No.	Duplicate Pairs	GC/MD Analyses		GC/MS Analyses
			Replicate	Total	
C3IL	10	1	1	12	2
C6IL	9	1	1	11	2
GRMI	9	1	1	11	2
M1NY	9	1	1	11	2
MNY	9	1	1	11	2
NWNJ	9	1	1	11	2
PLNJ	9	1	1	11	2
Total	64	7	7	78	14

TABLE 7-2. COMPOUND IDENTIFICATION WITH GC/MD FOR ALL 3-HOUR SITES

Cases Compounds	%	No.	Minimum ppbv	Maximum ppbv	Mean ppbv
Acetylene	14	9	1.02	17.33	5.09
Propylene	19	12	1.52	19.46	6.70
1,3-Butadiene	67	43	0.05	1.58	0.42
Chloroethane	6	4	0.05	1.49	0.60
Bromomethane	5	3	0.05	0.07	0.06
Methylene chloride	17	11	0.93	9.94	2.89
Chloroprene	44	28	0.03	1.30	0.24
Chloroform	5	3	0.09	0.10	0.10
1,1,1-Trichloroethane	98	63	0.28	6.87	1.66
Carbon tetrachloride	100	64	0.11	0.23	0.15
Benzene	100	64	0.13	8.78	2.66
Trichloroethylene	80	51	0.03	7.56	0.73
1,2-Dichloropropane	14	9	0.07	1.64	0.80
Bromodichloromethane	2	1	0.08	0.08	0.08
Toluene	100	64	0.24	54.31	8.22
n-Octane/trans-1,3-dichloropropylene	6	4	0.12	1.87	1.03
cis-1,3-Dichloropropylene	11	7	0.22	0.92	0.43
1,1,2-Trichloroethane	13	8	0.01	0.51	0.12
Tetrachloroethylene	59	38	0.04	4.85	1.31
Chlorobenzene	16	10	0.03	1.29	0.31
Ethylbenzene	100	64	0.04	16.48	1.07
m/p-Xylene	100	64	0.18	88.90	5.86
Styrene/o-Xylene	100	64	0.06	18.64	1.82
m-Dichlorobenzene	19	12	0.01	0.13	0.03
p-Dichlorobenzene	44	28	0.05	2.54	0.61
o-Dichlorobenzene	14	9	0.07	0.40	0.20

compound was identified, the minimum, maximum, and mean (arithmetic average) concentrations of the compound in ppbv. The target compounds identified fall into at least four categories: (1) those occurring in more than 70% of the samples tested, (2) those occurring in from 10% to 27% of the samples, (3) those occurring in less than 10% of the samples, and (4) those not identified in any of the 3-hour air samples at concentrations above their method detection limits. These results are summarized in Table 7-3.

Overall concentrations ranged from 0.01 ppbv for 1,1,2-trichloroethane and m-dichlorobenzene to 88.90 ppbv for m/p-xylene.

7.2 SITE RESULTS

Table 7-4 gives 3-hour ambient air concentrations by site code for the 38 target air toxics compounds. The overall site means range from 0.92 ppbv for C3IL to 5.34 for C6IL. Appendix tabulates the complete analytical results and includes the NMOC concentrations for each of the 3-hour air toxics samples. There appeared to be little correlation between the NMOC concentrations and the 38 target air toxics compound concentrations under investigation.

TABLE 7-3. FREQUENCY OF OCCURRENCE OF TARGET COMPOUNDS IN 3-HOUR AMBIENT AIR SAMPLES

Range for Frequency of Occurrence	Target Compounds	
100% to 70%	1,1,1-Trichloroethane Benzene Toluene m/p-Xylene	Carbon tetrachloride Trichloroethylene Ethylbenzene Styrene/o-xylene
69% to 40%	1,3-Butadiene Tetrachloroethylene	Chloroprene p-Dichlorobenzene
20% to >0%	Acetylene Chloroethane Methylene chloride 1,2-Dichloropropane n-Octane/ t-1,3-dichloropropylene 1,1,2-Trichloroethane m-Dichlorobenzene	Propylene Bromomethane Chloroform Bromodichloromethane cis-1,3-Dichloropropylene Chlorobenzene o-Dichlorobenzene
Zero	Vinyl chloride trans-1,2-Dichloroethylene Bromochloromethane Dibromochloromethane	Chloromethane 1,1.-Dichloroethane 1,2-Dichloroethane Bromoform

TABLE 7-4. COMPOUND IDENTIFICATIONS WITH GC/MD BY SITE CODE

Site Code	Compound	Cases	Minimum ppbv	Maximum ppbv	Mean ppbv
C3IL	Acetylene	2	1.73	3.27	2.50
	1,3-Butadiene	1	0.05	0.05	0.05
	Chloroethane	1	0.05	0.05	0.05
	Bromomethane	1	0.07	0.07	0.07
	Methylene chloride	3	1.32	2.07	1.67
	Chloroprene	5	0.06	0.13	0.10
	1,1,1-Trichloroethane	9	0.75	3.13	1.41
	Carbon tetrachloride	10	0.13	0.15	0.14
	Benzene	10	0.25	2.44	1.19
	Trichloroethylene	8	0.14	0.74	0.43
	1,2-Dichloropropane	1	0.46	0.46	0.46
	Bromodichloromethane	1	0.08	0.08	0.08
	Toluene	10	0.24	6.59	2.81
	cis-1,3-Dichloropropylene	2	0.22	0.31	0.27
	Tetrachloroethylene	5	0.09	1.82	1.05
	Ethylbenzene	10	0.04	0.67	0.27
	m/p-Xylene	10	0.18	3.59	1.37
	Styrene/o-Xylene	10	0.06	1.09	0.43
	m-Dichlorobenzene	2	0	0.03	0.03
	p-Dichlorobenzene	3	0	0.84	0.37
	o-Dichlorobenzene	1	0	0.07	0.07
C6IL	Acetylene	2	1.75	17.33	9.54
	1,3-Butadiene	7	0.31	1.58	0.91
	Methylene chloride	1	2.78	2.78	2.78
	Chloroprene	7	0.03	1.30	0.35
	1,1,1-Trichloroethane	9	0.98	6.87	2.89
	Carbon tetrachloride	9	0.11	0.21	0.16
	Benzene	9	2.20	8.78	5.63
	Trichloroethylene	9	0.37	1.76	0.93
	1,2-Dichloropropane	3	1.04	1.64	1.34
	Toluene	9	9.05	54.31	19.52
	n-Octane/trans-1-3-dichloropropylene	1	1.53	1.53	1.53
	1,1,2-Trichloroethane	3	0.03	0.08	0.06
	Tetrachloroethylene	3	1.76	2.98	2.17
	Chlorobenzene	2	0.03	0.95	0.49
	Ethylbenzene	9	1.05	16.48	3.57
	m/p-Xylene	9	5.64	88.90	19.19
	Styrene/o-Xylene	9	1.80	18.64	5.24
	m-Dichlorobenzene	1	0.02	0.02	0.02
	p-Dichlorobenzene	4	0.82	1.21	1.08
	o-Dichlorobenzene	2	0.12	0.40	0.26
	Propylene	1	19.46	19.46	19.46

(Continued)

TABLE 7-4. (Continued)

Site Code	Compound	Cases	Minimum ppbv	Maximum ppbv	Mean ppbv
GRMI	1,3-Butadiene	7	0.10	0.96	0.52
	Chloroprene	3	0.10	0.13	0.12
	1,1,1-Trichloroethane	9	0.76	3.50	2.14
	Carbon tetrachloride	9	0.13	0.20	0.15
	Benzene	9	1.16	5.99	2.91
	Trichloroethylene	9	0.12	7.56	1.81
	1,2-Dichloropropane	2	0.07	1.14	0.61
	Toluene	9	2.07	17.79	7.92
	n-Octane/trans-1,3-dichloropropylene	1	1.87	1.87	1.87
	Tetrachloroethylene	6	0.07	0.38	0.21
	Chlorobenzene	1	0.04	0.04	0.04
	Ethylbenzene	9	0.41	2.17	0.97
	m/p-Xylene	9	2.07	11.83	5.42
	Styrene/o-Xylene	9	0.64	3.58	1.67
	p-Dichlorobenzene	3	0.21	0.67	0.35
	Propylene	1	9.58	9.58	9.58
M1NY	1,3-Butadiene	8	0.14	0.54	0.31
	Chloroethane	2	0.74	1.49	1.12
	Bromomethane	1	0.05	0.05	0.05
	Methylene chloride	1	2.51	2.51	2.51
	Chloroprene	2	0.09	0.18	0.14
	Chloroform	1	0.09	0.09	0.09
	1,1,1-Trichloroethane	9	0.62	4.87	1.79
	Carbon tetrachloride	9	0.13	0.23	0.16
	Benzene	9	0.13	7.80	2.78
	Trichloroethylene	7	0.06	0.57	0.21
	Toluene	9	2.84	25.01	7.70
	n-Octane/trans-1,3-dichloropropylene	1	0.12	0.12	0.12
	cis-1,3-Dichloropropylene	1	0.25	0.25	0.25
	1,1,2-Trichloroethane	1	0.11	0.11	0.11
	Tetrachloroethylene	4	0.61	1.91	1.50
	Chlorobenzene	1	0.13	0.13	0.13
	Ethylbenzene	9	0.28	2.06	0.75
	m/p-Xylene	9	1.54	12.01	4.35
	Styrene/o-Xylene	9	0.14	4.55	1.51
	m-Dichlorobenzene	3	0.01	0.02	0.01
	p-Dichlorobenzene	5	0.16	1.41	0.64
	Propylene	5	3.41	14.19	6.96

(Continued)

TABLE 7-4. (Continued)

Site Code	Compound	Cases	Minimum ppbv	Maximum ppbv	Mean ppbv
MNY	Acetylene	4	1.02	8.69	4.47
	1,3-Butadiene	9	0.10	0.62	0.24
	Chloroethane	1	0.11	0.11	0.11
	Methylene chloride	1	1.87	1.87	1.87
	Chloroprene	5	0.08	0.52	0.28
	Chloroform	2	0.10	0.10	0.10
	1,1,1-Trichloroethane	9	0.56	1.79	1.03
	Carbon tetrachloride	9	0.14	0.17	0.15
	Benzene	9	0.94	4.18	1.88
	Trichloroethylene	[illegible]	0.03	0.22	0.12
	Toluene	9	2.01	13.38	5.10
	cis-1,3-Dichloropropylene	1	0.29	0.29	0.29
	1,1,2-Trichloroethane	1	0.11	0.11	0.11
	Tetrachloroethylene	7	1.07	4.85	3.01
	Chlorobenzene	1	0.20	0.20	0.20
	Ethylbenzene	9	0.19	1.24	0.50
	m/p-Xylene	9	1.16	6.86	2.83
	Styrene/o-Xylene	9	0.44	2.52	1.08
	m-Dichlorobenzene	2	0.01	0.03	0.02
	p-Dichlorobenzene	4	0.13	0.30	0.19
	o-Dichlorobenzene	2	0.23	0.30	0.27
	Propylene	4	2.39	6.22	3.75
NWNJ	1,3-Butadiene	7	0.08	0.96	0.32
	Methylene chloride	3	0.93	5.57	2.60
	Chloroprene	2	0.07	0.56	0.31
	1,1,1-Trichloroethane	9	0.49	2.57	1.33
	Carbon tetrachloride	9	0.13	0.21	0.15
	Benzene	9	0.92	5.98	2.47
	Trichloroethylene	7	0.11	1.95	0.80
	1,2-Dichloropropane	2	0.29	0.93	0.61
	Toluene	9	2.40	23.67	10.27
	n-Octane/trans-1,3-dichloropropylene	1	0.61	0.61	0.61
	cis-1,3-Dichloropropylene	1	0.92	0.92	0.92
	1,1,2-Trichloroethane	1	0.51	0.51	0.51
	Tetrachloroethylene	7	0.15	1.78	1.00
	Chlorobenzene	2	0.26	1.29	0.78
	Ethylbenzene	9	0.33	2.44	1.03
	m/p-Xylene	9	2.02	14.04	5.80
	Styrene/o-Xylene	9	0.66	5.06	1.91
	m-Dichlorobenzene	3	0.02	0.13	0.06
	p-Dichlorobenzene	4	0.08	2.54	0.71
	o-Dichlorobenzene	1	0.09	0.09	0.09

(Continued)

TABLE 7-4. (Continued)

Site Code	Compound	Cases	Minimum ppbv	Maximum ppbv	Mean ppbv
PLNJ	Acetylene	1	3.89	3.89	3.89
	1,3-Butadiene	4	0.14	0.46	0.31
	Bromomethane	1	0.06	0.06	0.06
	Methylene chloride	2	1.87	9.94	5.91
	Chloroprene	4	0.10	0.47	0.25
	1.1,1-Trichloroethane	9	0.28	2.04	1.02
	Carbon tetrachloride	9	0.13	0.17	0.15
	Benzene	9	0.49	3.48	1.91
	Trichloroethylene	4	0.16	0.47	0.27
	1,2-Dichloropropane	1	0.26	0.26	0.26
	Toluene	9	1.04	8.95	4.85
	cis-1,3-Dichloropropylene	2	0.30	0.71	0.51
	1,1,2-Trichloroethane	2	0.01	0.07	0.04
	Tetrachloroethylene	6	0.04	1.30	0.47
	Chlorobenzene	3	0.04	0.06	0.05
	Ethylbenzene	9	0.08	0.99	0.47
	m/p-Xylene	9	0.40	5.35	2.56
	Styrene/o-Xylene	9	0.18	1.89	1.06
	m-Dichlorobenzene	1	0.01	0.01	0.01
	p-Dichlorobenzene	5	0.05	1.86	0.73
	o-Dichlorobenzene	3	0.10	0.26	0.19
	Propylene	1	1.52	1.52	1.52

8.0 THREE-HOUR AIR TOXICS TECHNICAL NOTES

This section describes the equipment used to sample and analyze the 3-hour air toxics samples. Also described are sample handling procedures, sampler certification procedures, standards generation and instrument calibration procedures, compound identification procedures, GC/MS compound identification confirmation, quality assurance/quality control procedures, and data records for the 3-hour air toxics compounds.

8.1 SAMPLING EQUIPMENT AND INTERFACE

The sampling equipment for the 3-hour air toxics samples was the NMOC Monitoring Program sampling equipment described in Section 3.1. The original sample was collected as an integrated ambient air sample from 6:00 a.m. to 9:00 a.m. with a final sample pressure of about 16 psig. As stated above, after NMOC analysis the canister was bled to atmospheric pressure and allowed to stand at least 18 hours before being analyzed by GC/MD.

An interface system was designed and built by Radian Corporation to take a sample from the canister and inject it into the gas chromatograph for analysis.

Figure 8-1 shows the GC/MD system including the Sample Interface System, Analytical System, and Data System. The sample interface takes a 250-mL sample approximately from the canister, draws it through Trap Assembly 1 and condenses all the water and organic compounds, with the exception of methane, in the air sample drawn from the canister. Trap Assembly 1 is a cryogenic, liquid argon trap packed with glass beads. The cryogen is removed, and an electrical heater quickly heats Trap Assembly 1, vaporizing the water and organic compounds condensed from the canister sample.

8.2 THREE-HOUR AIR TOXICS SAMPLING SYSTEMS CERTIFICATION

The sampling systems used to collect 3-hour air toxics samples were certified for use per the specifications described in U.S. EPA Compendium of Methods TO-14.[16]

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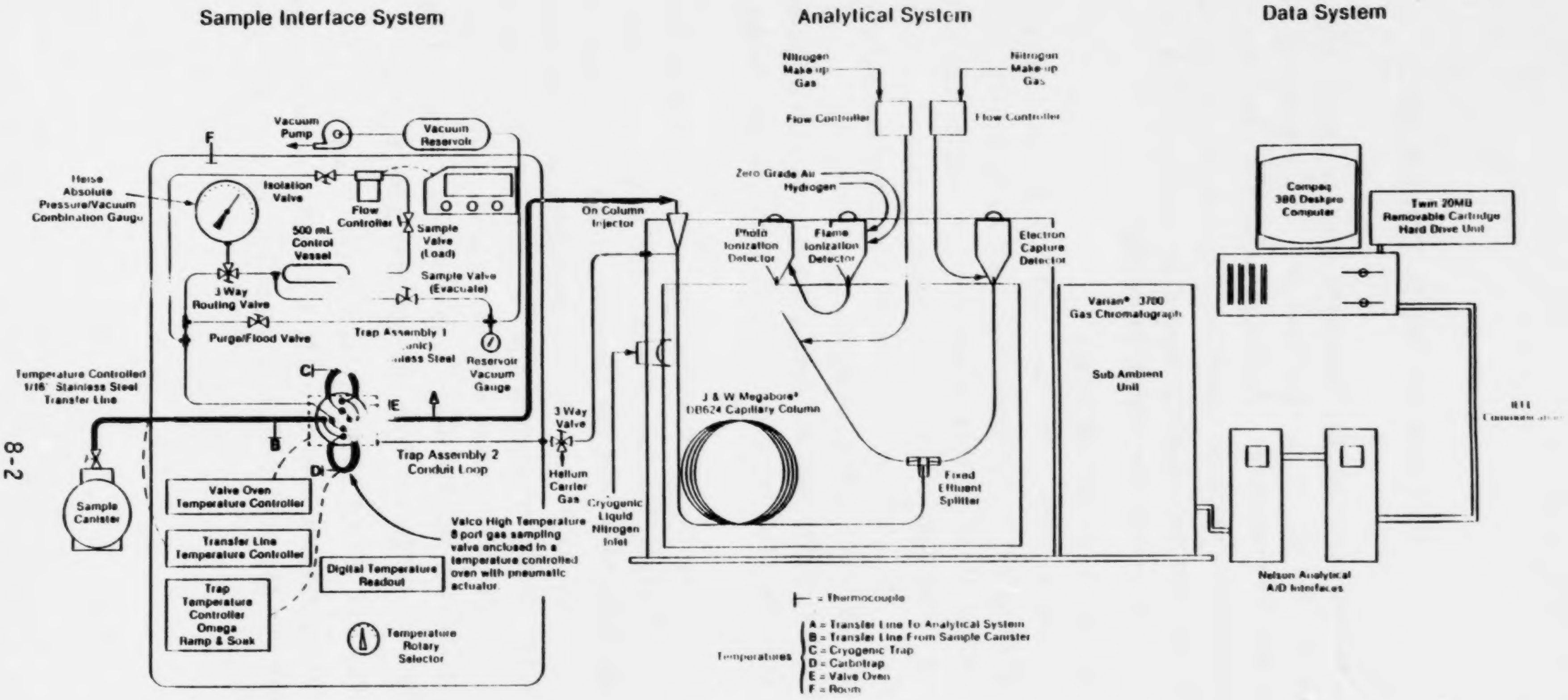

Sample Interface System
Analytical System
Data System
Vacuum Pump
Vacuum Reservoir
F
Heise Absolute Pressure/Vacuum Combination Gauge
Isolation Valve
Flow Controller
Sample Valve (Load)
500 mL Control Vessel
3 Way Routing Valve
Sample Valve (Evacuate)
Purge/Flood Valve
Trap Assembly 1
…anic)
…less Steel
Reservoir Vacuum Gauge
Temperature Controlled 1/16" Stainless Steel Transfer Line
C
E
A
B
D
Trap Assembly 2 Conduit Loop
Sample Canister
Valve Oven Temperature Controller
Transfer Line Temperature Controller
Trap Temperature Controller Omega Ramp & Soak
Digital Temperature Readout
Valco High Temperature 8 port gas sampling valve enclosed in a temperature controlled oven with pneumatic actuator
Temperature Rotary Selector
3 Way Valve
Helium Carrier Gas
Cryogenic Liquid Nitrogen Inlet
On Column Injector
Nitrogen Make-up Gas
Flow Controller
Nitrogen Make-up Gas
Flow Controller
Zero Grade Air
Hydrogen
Photo Ionization Detector
Flame Ionization Detector
Electron Capture Detector
J & W Megabore® DB624 Capillary Column
Fixed Effluent Splitter
Varian® 3700 Gas Chromatograph
Sub Ambient Unit
Compaq 386 Deskpro Computer
Twin 20MB Removable Cartridge Hard Drive Unit
IEEE Communication
Nelson Analytical A/D Interfaces
⊢ = Thermocouple
Temperatures
A = Transfer Line To Analytical System
B = Transfer Line From Sample Canister
C = Cryogenic Trap
D = Carbotrap
E = Valve Oven
F = Room

Figure 8-1. Gas chromatographic multidetector system.

128178BR

8.2.1 Certification Blanks - Humidified Zero Air

Zero certification consisted of purging the sampler with cleaned, humidified air, followed by collecting a sample of the cleaned, dried air that had been humidified through the purged NMOC samplers for GC/MD analysis. The purpose of the wet purge was to help remove any adherent contaminants from the sampler. The chromatograms from these certification sample analyses were archived for each sampler. Results presented in Table 8-1 showed a range of 0.00 ppmC to 0.013 ppmC of NMOC, with an average of 0.006 ppmC. The sampling systems were determined to be very clean and showed no characteristics of additive bias.

8.2.2 Sampler Certification Selected Target Compound Challenge

Following the NMOC sampler blank certification, a challenge gas containing seven selected target compounds was passed through the samplers. The average concentration of the compounds in the challenge gas was 15.3 ppbv/species. Table 8-2 shows the average system percent bias calculated with the analysis of the challenge gas being used as a reference concentration.

System percent bias ranged from -6.4% to 3.2% with an overall average of 0.5 percent. The systems showed acceptable subtractive bias characteristics.

8.3 STANDARDS GENERATION

The GC/MD analytical equipment was calibrated daily with a gas mixture that averaged 5 ppbv of each of the 38 target compounds at 70% relative humidity.

The standard gas mixtures were generated by dynamic flow dilutions of Scott certified gas mixtures with cleaned, dried air that had been humidified with HPLC-grade water. The Scott gas mixtures were dry and contained in cylinders under pressure at a concentration of about 120 ppbv per compound for two of the standards, and about 500 ppbv for one of the standards. The concentration for each target gas in the 120 ppbv Scott cylinders was certified to ±5% with the exception of the bromoform which was certified to ±20 percent. The concentration for each target gas in the 500 ppbv Scott cylinder was certified to within ±10 percent.

TABLE 8-1. ZERO CERTIFICATION RESULTS

Canister Number	Canister Blank Date	Blank Sample Concentration (ppmC)	Sampler System Number	Sampler Zero Collection Date	Sampler Zero Sample (ppmC)	Difference (ppmC)
041	5-18-89	0.005	31	5-20-89	0.003	-0.002
104	5-18-89	0.002	22	5-20-89	0.007	0.005
902	5-18-89	0.005	27	5-20-89	0.000	-0.005
868	5-18-89	0.003	21	5-20-89	0.010	0.007
643	5-18-89	0.000	23	5-20-89	0.006	0.006
401	5-18-89	0.004	44	5-20-89	0.002	-0.002
180	5-18-89	0.016	17	5-20-89	0.013	-0.003
071	5-18-89	0.000	1	5-20-89	0.009	0.009
				Average	0.006	

TABLE 8-2. CHALLENGE CERTIFICATION RESULTS

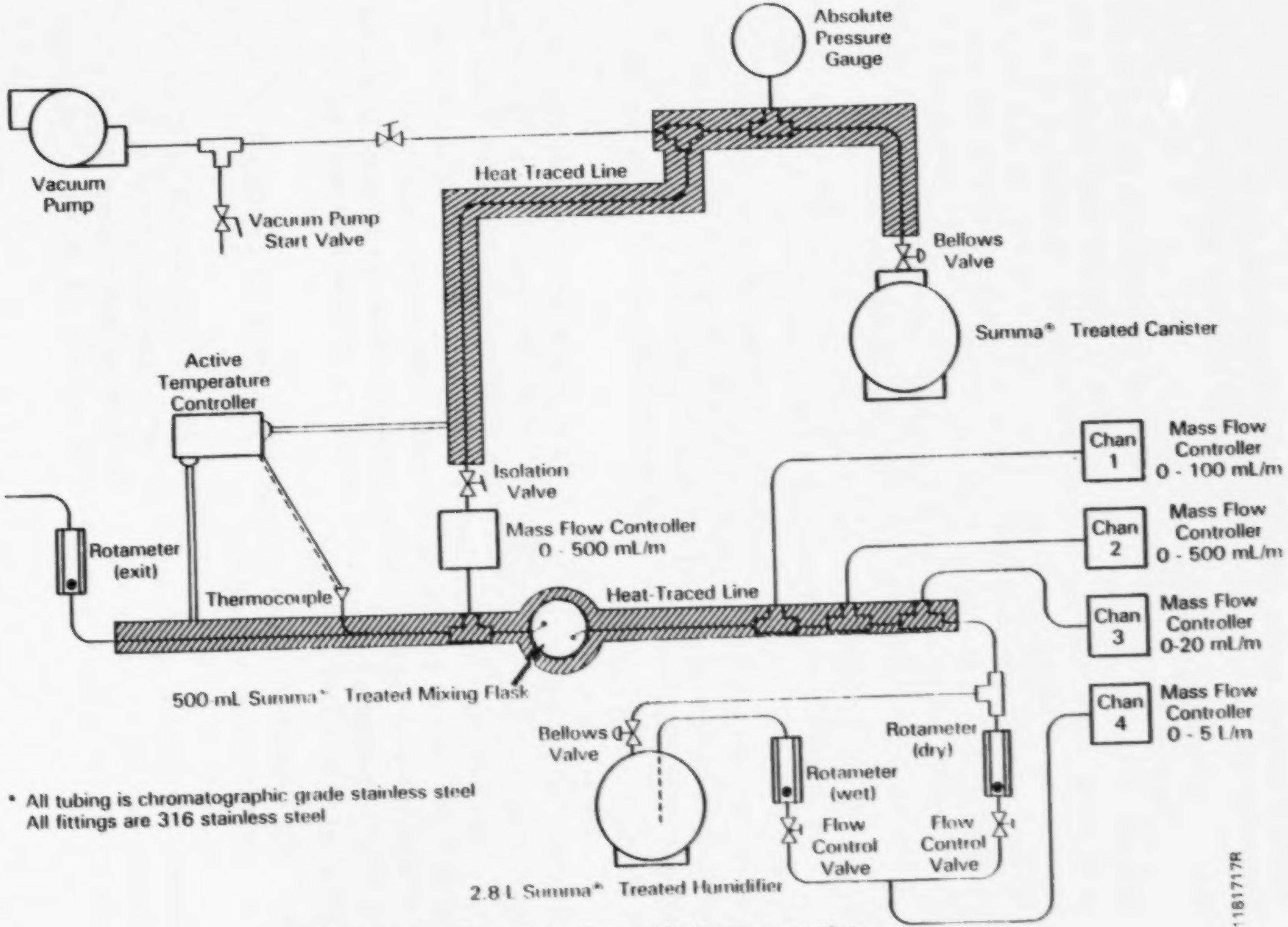
System Number		Percent	
		Average Compound Recovery	System Bias
31		101.9	1.9
22		101.6	1.6
27		103.2	3.2
21		93.6	-6.4
23		102.9	2.9
44		100.4	0.4
17		98.9	-1.1
1		101.7	1.7
	Average	100.5	0.5

Figure 8-2 diagrams the dynamic flow dilution apparatus. One Scott cylinder contains 18 of the air toxics target compounds, a second Scott cylinder contains 11 target compounds, while the third Scott cylinder contains the remaining 9 target compounds. The three Scott cylinders were connected to Channels 1, 2, and 3 of the flow dilution apparatus. The fourth channel was connected to a cylinder of zero-grade air by way of a catalytic oxidizer that oxidized all of the hydrocarbon material in the zero-grade air. The four mass flow controllers were set to flow rates that would give the desired final concentration of the diluted gas.

The cleaned zero-grade air was partially humidified by bubbling part of the air stream through HPLC-grade water contained in a stainless steel canister. The wet and dry rotameters and all the mass flow controllers were calibrated with a bubble flowmeter before being connected to the flow dilution apparatus. All of the flow controllers, the connecting lines, and the mixing flask were heat traced to reduce adsorption of the target compounds. The temperature controller that regulated electrical current flow to the heat tracing was set for 100°C.

To generate a standard, the following procedure is used. The canister into which the standard is being mixed is connected to the flow dilution apparatus at the bellows valve shown in Figure 8-2. The temperature controller for the heat tracing is activated. The mass flow controllers are then set for the appropriate flow rate to obtain the desired dilution and the humidifier, lines, and mixing flask are purged for at least 10 minutes. The isolation valve is closed and the vacuum pump turned on. The tubing, the canister, and the absolute pressure gauge are all evacuated initially to about 5 mm Hg absolute pressure. The vacuum pump is then isolated from the system and the isolation valve is opened to the diluted gas mixture. The standard mixture fills the canister at a controlled rate until atmospheric pressure is reached. The canister with the diluted standard is disconnected from the flow dilution apparatus and allowed to equilibrate before use. The barometric pressure and room temperature are also recorded.

In order to calculate the exact concentration of each target compound in the standard mixture, a correction is made for the residual gas in the


Absolute Pressure Gauge
Vacuum Pump
Vacuum Pump Start Valve
Heat-Traced Line
Bellows Valve
Summa® Treated Canister
Active Temperature Controller
Isolation Valve
Mass Flow Controller 0 - 500 mL/m
Rotameter (exit)
Thermocouple
Heat-Traced Line
500-mL Summa® Treated Mixing Flask
Chan 1
Mass Flow Controller 0 - 100 mL/m
Chan 2
Mass Flow Controller 0 - 500 mL/m
Chan 3
Mass Flow Controller 0-20 mL/m
Chan 4
Mass Flow Controller 0 - 5 L/m
Bellows Valve
Rotameter (dry)
Rotameter (wet)
Flow Control Valve
Flow Control Valve
2.8 L Summa® Treated Humidifier
1181717R

* All tubing is chromatographic grade stainless steel
All fittings are 316 stainless steel

Figure 8-2. Dynamic flow dilution apparatus.

standard canister before the filling with the diluted gas is begun. A correction also is made for the water vapor added to the dilution air.

8.4 CALIBRATION ZERO AND SPAN

Most of the compound quantitation is performed with the calibrated response of the FID detector. For purposes of compound identification and quantitation (when there may be interference on the FID detector) it is also necessary to calibrate the PID and ECD responses. Initial calibration curves for each compound were generated on all three detectors with calibration standards at 1, 5, and 10 ppbv. In addition to the usual response (area counts) versus concentration curves, response times and response ratios for PID/FID and ECD/FID were determined for each target compound.

8.5 GAS CHROMATOGRAPH/MULTIDETECTOR ANALYSIS AND COMPOUND IDENTIFICATION

A Varian® 3700 gas chromatograph, configured with a PID in series with an FID and an ECD operating in parallel, performed the air toxics analyses. Fused silica was used for the detector-to-detector connections. The Air Toxics Multiple Detector System is shown in Figure 8-3 and diagrams the effluent splitter and multidetectors connected to the end of the Megabore® DB-624 capillary column.

The entire GC/MD system is shown in Figure 8-1, including the sample interface, the gas chromatograph/multidetector analytical system, and the data handling system. Sample volumes for the GC/MD analyses were about 250-mL.

Compound identification was performed using measured retention times and ratios of PID/FID and ECD/FID responses. The analyst's skill and experience was also needed in making a judgment about the presence or absence of a target compound because of the variability of response times, and the presence of interfering compounds.

8.6 GAS CHROMATOGRAPH/MASS SPECTROMETER ANALYSIS AND COMPOUND IDENTIFICATION CONFIRMATION

Fourteen of the 3-hour air toxics samples were analyzed by GC/MS for compound identification confirmation following completion of the GC/MD analyses. So that the sensitivity of the GC/MS compared favorably with that of the GC/MD, the GC/MS was operated in the multiple ion detection (MID) mode,

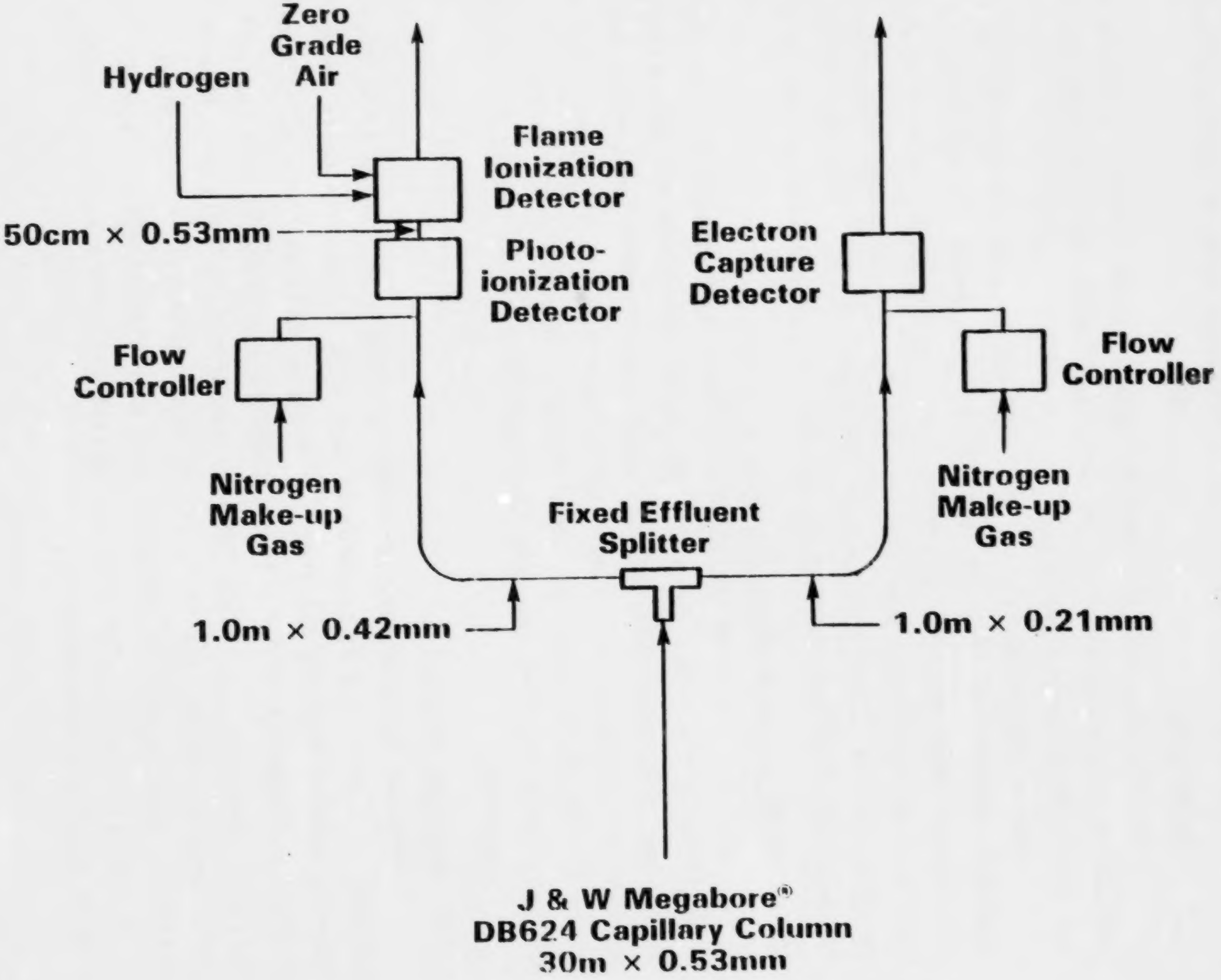

Zero
Grade
Air
Hydrogen
Flame
Ionization
Detector
50cm × 0.53mm
Photo-
ionization
Detector
Electron
Capture
Detector
Flow
Controller
Flow
Controller
Nitrogen
Make-up
Gas
Nitrogen
Make-up
Gas
Fixed Effluent
Splitter
1.0m × 0.42mm
1.0m × 0.21mm
J & W Megabore®
DB624 Capillary Column
30m × 0.53mm

Figure 8-3. Air toxics multiple detector system.

and the sample volume was about 500-mL (compared to 250-mL for the GC/MD analyses).

No comparison of the quantitative results for GC/MS and GC/MD was made, because the purpose of the GC/MS analyses was compound identification confirmation only. This comparison is discussed below in Section 8.7.4.

8.7 QA/QC DATA

Quality assurance and quality control in the 3-hour air toxics data included a determination of method detection limits (MDL) for both the GC/MD and the GC/MS analytical methods.

One of the objectives of the UATMP was to make the MDLs as low as possible, recognizing that the lower MDLs may increase the number of false positive or false negative identifications. Other quality measures reported here involved analytical precision results from repeated analyses, and sampling and analysis precision from duplicate samples. Accuracy was assessed for both the GC/MD and GC/MS using external audits supplied by the EPA-QAD.

8.7.1 GC/MD and GC/MS Minimum Detection Limits

MDLs for the GC/MD and GC/MS analytical systems used in this study are given in Table 8-3. MDLs for the GC/MD analytical system are estimated from the minimum area count that reflects approximately three times noise for every compound and are based on a sample approximately 250-mL in volume. The sample volume for the GC/MS system was about 500-mL. The GC/MS was operated in the MID mode, which detected specific ions representative of the 38 air toxics target compounds.

8.7.2 Repeated Analyses

Repeated analyses were performed on seven site samples by GC/MD. The analyses were performed on consecutive days with at least 24 hours between removing samples from the canister. From these analyses there were 70 cases in which a concentration for a target compound was found in both replicate analyses. Statistics for these data are summarized in Table 8-4, showing the overall minima, maxima, and means of the mean concentrations, standard deviations, coefficients of variation, and absolute percent differences for the 55 replicate pairs. The absolute percent difference averages 8.542%, which is excellent agreement.

TABLE 8-3. METHOD DETECTION LIMITS FOR 3-HOUR AIR TOXICS COMPOUNDS

Compound	GC/MD MDL ppbv	GC/MS MDL ppbv
Acetylene	1.00	-[a]
Propylene	0.10	0.40
Chloromethane	0.20	0.56
Vinyl chloride	0.20	0.44
1,3-Butadiene	0.10	0.57
Bromomethane	0.20	0.25
Chloroethane	0.10	0.38
Methylene chloride	0.11	0.31
trans-1,2-Dichloroethylene	0.04	0.39
1,1-Dichloroethane	0.04	0.53
Chloroprene	0.06	0.57
Bromochloromethane	0.01	0.48
Chloroform	0.01	0.27
1,1,1-Trichloroethane	0.01	0.70
Carbon tetrachloride	0.01	0.37
1,2-Dichloroethane	0.04	0.59
Benzene	0.04	0.34
Trichloroethylene	0.01	0.37
1,2-Dichloropropane	0.04	0.44
Bromodichloromethane	0.01	0.22
trans-1,3-Dichloropropylene	0.04	0.50
Toluene	0.02	0.50
n-Octane	0.03	0.29
cis-1,3-Dichloropropylene	0.04	0.80
1,1,2-Trichloroethane	0.02	0.22
Tetrachloroethylene	0.07	0.32
Dibromochloromethane	0.01	0.25
Chlorobenzene	0.02	0.57
Ethylbenzene	0.02	0.72
m/p-Xylene	0.04	0.46
Styrene/o-Xylene	0.02	--
Styrene	-	0.46
o-Xylene	-	0.39
Bromoform	0.01	0.27
1,1,2,2-Tetrachloroethane	0.01	0.37
m-Dichlorobenzene	0.02	0.28
p-Dichlorobenzene	0.09	0.56
o-Dichlorobenzene	0.02	0.37

[a] Below mass spectrometry range.

TABLE 8-4. 3-HOU. .R TOXICS REPLICATE ANALYSES BY GC/MD

Statistics	Minimum	Maximum	Overall Mean
Mean Concentration, ppbv	0.050	21.055	2.445
Standard Deviation, ppbv	-0.686	0.594	-0.016
Percent Coefficient of Variation	-43.889	7.421	-0.347
Absolute Percent Difference	0.000	62.069	9.118

The percent coefficients of variation are plotted against the replicate sample means in Figure 8-4 and show that the largest contributions to the overall variance occurs in the samples having means less than 2 ppbv.

Table 8-5 lists the cases in which a target compound was found in only one of the replicate analyses. For all cases, the concentration was below 1.0 ppbv, which suggests that the variability of the analyses at the lower concentration levels may explain in part why one compound was seen in one replicate analysis, but not in the other. Although the list of single compound identifications is not long, no pattern to the behavior emerges.

8.7.3 Duplicate Sample Results

Fourteen duplicate 3-hour ambient air samples were analyzed by GC/MD for the 38 target compounds. Summary precision results are given in Table 8-6 in terms of mean concentration and concentration range in ppbv. Other precision statistics are given in terms of standard deviation, percent coefficients of variation, and absolute percent difference. The data in Table 8-6 are accumulated over all compounds and site locations.

The percent coefficients of variation ranged from -64.282% to 101.015%, averaging -0.814 percent. These data are also plotted in Figure 8-5 and show that the larger values of percent coefficient of variation are at the duplicate mean concentrations below 2 ppbv.

Table 8-7 also shows that the imprecision is also compound specific. Mean absolute percent difference for m-dichlorobenzene is 142.857%; the concentration range is 0.01 ppbv to 0.06 ppbv. For the other selected compounds in Table 8-7, the absolute percent difference means ranged from 0.433% to 57.464 percent. The precision for the 3-hour air toxics compounds is good with an overall average absolute percent difference of 12.9 percent.

Table 8-8 lists the compounds that were identified in only one of the duplicate sample analyses. Except for one case, the concentration was below 1.0 ppbv for the compound identified in only one duplicate sample analysis. It may be argued that some of the identifications were false positives, but such an hypothesis is not reasonable for cases in which the concentration was greater than 1.0 ppbv. In the case of p-dichlorobenzene, a concentration of 1.14 ppbv was verified on the chromatographic traces for one of the duplicates, and was completely absent on the traces for the other duplicate.

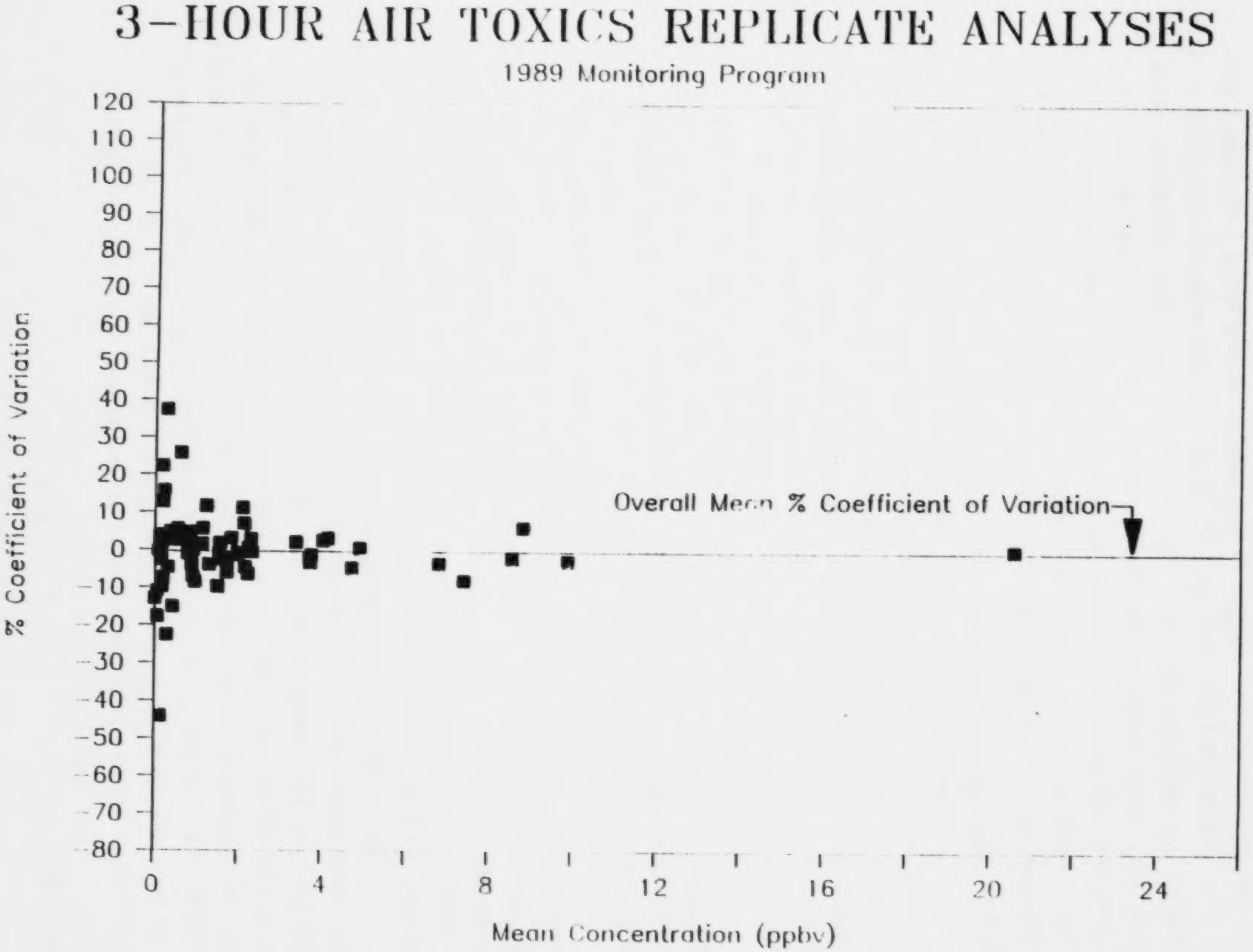


Figure 8-4. Percent coefficient of variation of 3-hour air toxics replicate analyses as a function of mean concentration.

TABLE 8-5. GC/MD COMPOUND IDENTIFICATIONS IN ONLY ONE REPLICATE ANALYSIS

Compound	Concentration ppbv	Radian ID
Chloroprene	0.05	2348 R2
Trichloroethylene	0.60	2314 R2
Trichloroethylene	0.04	2284 R2
cis-1,3-Dichloropropylene	0.25	2348 R2
1,1,2-Trichloroethane	0.06	2388 R2
Tetrachloroethylene	0.53	2093 R2
Tetrachloroethylene	0.73	2314 R2
Chlorobenzene	0.27	2284 R2
Chlorobenzene	0.04	2093 R1
Chlorobenzene	0.03	2314 R2
m-Dichlorobenzene	0.01	2169 R1
m-Dichlorobenzene	0.02	2388 R2
m-Dichlorobenzene	0.02	2348 R2
p-Dichlorobenzene	0.97	2348 R2
p-Dichlorobenzene	0.08	2169 R2
o-Dichlorobenzene	0.09	2169 R2

TABLE 8-6. THREE-HOUR AIR TOXICS DUPLICATE SAMPLE ANALYSES BY GC/MD

Statistics	Minimun	Maximum	Overall Mean
Mean Concentration, ppbv	0.035	21.380	2.3[illegible]
Standard Deviation, ppbv	-0.721	0.481	-0.027
Percent Coefficient of Variation	-64.282	101.015	-0.814
Absolute Percent Difference	0.000	142.857	11.149

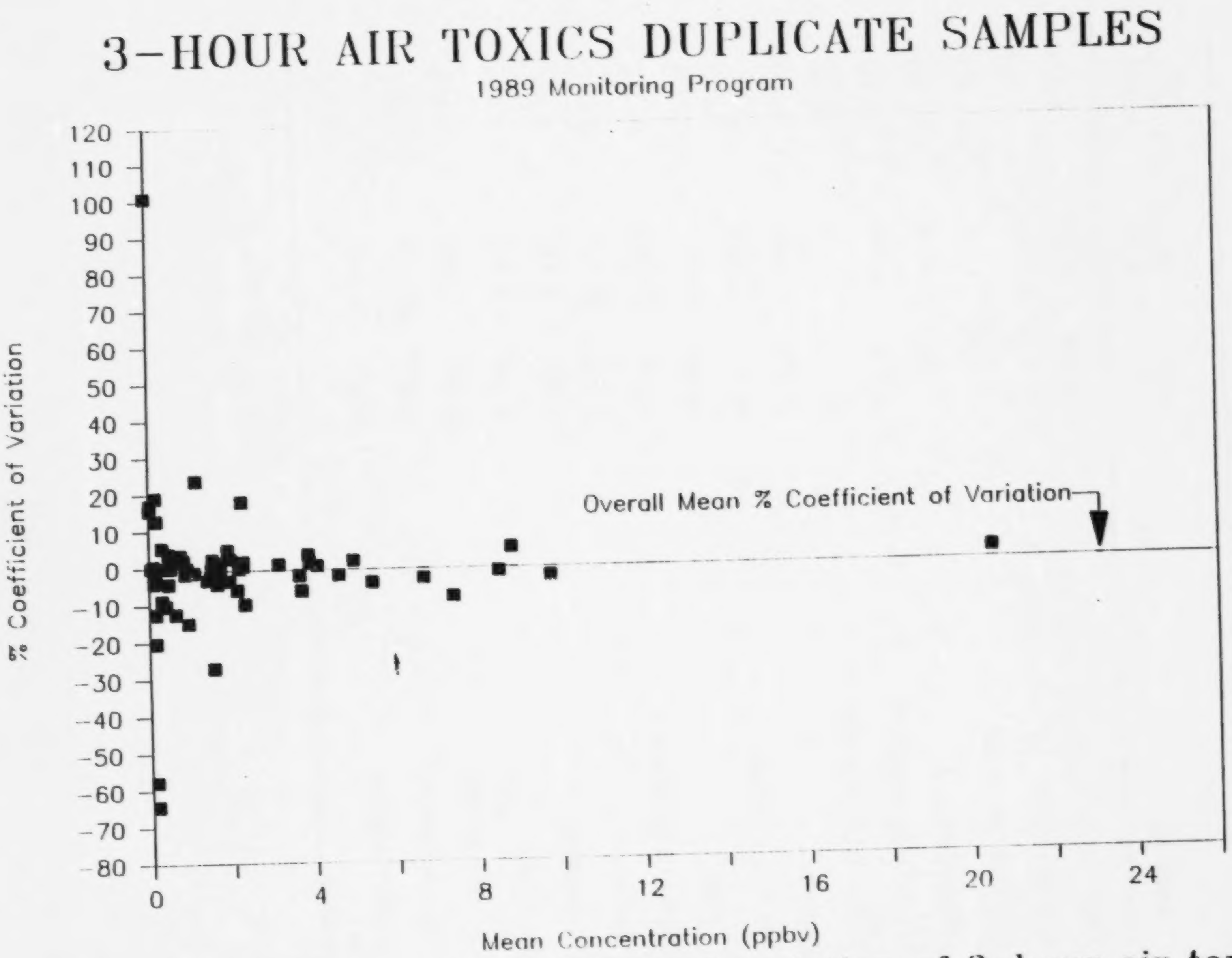


Figure 8–5. Percent coefficient of variation of 3–hour air toxics duplicate samples as a function of mean concentration.

TABLE 8-7. GC/MD 3-HOUR AIR TOXICS DUPLICATE PRECISION BY COMPOUND

Compound	Cases	Mean SD	Mean % CV	Mean Absolute % Diff
Propylene	1	0.014	0.306	0.433
1,3-Butadiene	6	-0.011	-4.854	7.470
Methylene chloride	3	0.125	0.336	3.826
Chloroprene	3	-0.061	-40.633	57.464
1,1,1-Trichloroethane	7	-0.034	-2.736	4.930
Carbon tetrachloride	7	-0.005	-3.349	4.966
Benzene	7	-0.074	-1.640	5.427
Trichloroethylene	5	0.051	6.542	21.230
Toluene	7	0.005	-0.091	3.785
Tetrachloroethylene	1	0.410	17.909	25.328
Chlorobenzene	1	0.007	15.713	22.[illegible]
Ethylbenzene	7	-0.017	-0.271	3.038
m/p-Xylene	7	-0.180	-1.934	3.667
Styrene/o-Xylene	7	-0.025	2.997	7.440
m-Dichlorobenzene	1	0.035	101.015	142.857
p-Dichlorobenzene	2	-0.223	-13.540	19.149

TABLE 8-8. SINGLE COMPOUND IDENTIFICATIONS OF GC/MD DUPLICATE SAMPLE ANALYSES

Compound	Concentration ppbv	Radian ID
Bromomethane	0.05	2348 D
Chloroprene	0.10	2314 D
Chloroprene	0.18	2388 D
Chloroprene	0.05	2349 D
Trichloroethylene	0.34	2315 D
cis-1,3-Dichloropropylene	0.71	2315 D
1,1,2-Trichloroethane	0.71	2315 D
1,1,2-Trichloroethane	0.05	2388 D
Tetrachloroethylene	0.22	2094 D
Tetrachloroethylene	0.78	2314 D
Chlorobenzene	0.03	2389 D
Chlorobenzene	0.13	2285 D
Chlorobenzene	0.07	2315 D
m-Dichlorobenzene	0.03	2284 D
p-Dichlorobenzene	1.14	2348 D
o-Dichlorobenzene	0.12	2389 D

8.7.4 GC/MS Confirmation Results

Based on 14 GC/MS analyses of the 3-hour air toxics samples, one from each site location, the following results were obtained. The GC/MS analyses confirmed 93.90% of the GC/MD analyses. The results are summarized in Table 8-9, showing 31.56% positive GC/MD-positive GC/MS confirmation, 2.52% positive GC/MD-negative GC/MS confirmation, 3.57% negative GC/MD-positive GC/MS comparisons, and 62.39% negative GC/MD-negative GC/MS comparisons.

8.7.5 External Audits

Bi-monthly external audits were conducted for the 3-hour air toxics and UATMP by the EPA-QAD. The results for Audit No. 3, performed prior to the 3-hour air toxics analysis period,[8] are reported in Table 8-10. The bias ranged from -32 to +18%, averaging -7.3% bias, for the GC/MD analyses. The bias ranged from -46 to -2.9%, averaging -20.5% bias, for the GC/MS analyses. These are excellent results for the GC/MD analytical procedure since that instrument was to be used for primary quantification in the UATMP. The GC/MS analyses are done primarily for compound identification confirmation of the GC/MD identification.

8.8 DATA RECORDS

Data records for the 3-hour air toxics samples include:

- NMOC concentration of the sample;
- Copies of the gas chromatographic trace for FID, PID, and ECD;
  - Response data on Bernoulli disk;
  - Retention time for each compound; and
  - Area counts for each detector.

In addition, daily calibration response factors are recorded on magnetic disk along with the retention time and area counts for each compound in the standard.

TABLE 8-9. COMPOUND IDENTIFICATION CONFIRMATION

GC/MD versus GC/MS comparison	Cases	Percentage
Positive GC/MD - Positive GC/MS	150	31.51
Positive GC/MD - Negative GC/MS	12	2.52
Negative GC/MD - Positive GC/MS	17	3.57
Negative GC/MD - Negative GC/MS	297	62.39
Total	476	99.99%

Total compound identification confirmation = 31.51% + 62.39% = 93.90%

TABLE 8-10. 3-HOUR AIR TOXICS AUDIT NO. 3 RESULTS FOR GC/MD AND GC/MS

	Spiked ppb	Reported ppb		Bias %	
		GC/MD	GC/MS	GC/MD	GC/MS
Vinyl chloride	4.1	3.5	3.4	-15	-17
Bromomethane	8.5	7.2	7.0	-15	-18
Carbon tetrachloride	3.8	3.7	3.4	-2.6	-10
Methylene chloride	3.9	4.6[1]	2.1	18	-46
Chloroform	3.4	3.4	3.3	0.0	-2.9
1,1,1-Trichloroethane	8.1	7.7	6.7	-4.9	-17
1,2-Dichloroethane	4.3	3.6	3.1	-16	-28
Benzene	4.4	3.8	2.9	-14	-34
Toluene	8.2	7.7	6.5	-6.1	-21
Tetrachloroethylene	3.8	2.6	3.1	-32	-18
Chlorobenzene	8.1	8.4	6.9	3.7	-15
o-Xylene	7.2	7.8	6.7	8.3	-6.9
Trichloroethylene	4.4	3.7	3.3	-16	-25
1,2-Dichloropropane	8.0	7.6	6.7	-5.0	-16
Ethylbenzene	7.5	5.8	5.0	-23	-33

[1] Interference reported.

$$\text{Bias, \%} = \frac{\text{reported - actual}}{\text{actual}} \times 100$$

9.0 RECOMMENDATIONS, THREE-HOUR AIR TOXICS PROGRAM

The following recommendations derive from the 3-hour Air Toxics Monitoring Program. The studies (Sections 9.1, 9.2, and 9.3) are directed toward areas in which additional information is needed to validate further the air toxics results. The final suggestion (Sections 9.4) is designed to give additional information useful to the project without increasing the overall number of analyses.

9.1 COMPOUND STABILITY STUDIES

Compound stability in this context refers to whether the apparent concentration of a compound in a sample taken from a canister is changing over time. The apparent change in concentration may result from a chemical reaction of the compound while it is in the canister, or result from a change in the gas phase concentration caused by adsorption of the compound on the interior canister surfaces.

A study needed to investigate this phenomenon would take several canisters--at least three from each initial concentration--ranging in target compound concentration from zero to 20 ppbv. The canisters would be analyzed 24 hours after mixing, 72 hours after mixing, 30 days after mixing, and 60 days after mixing to determine any concentration changes. It is also recommended that the same concentrations be mixed in canisters, but that equilibration times of 7 days and 30 days be assigned before the first samples are drawn from the canisters to determine the effect of equilibration time on the concentration samples withdrawn from the canisters.

9.2 CANISTER CLEANUP STUDIES

The present canister cleanup procedure has not been studied in sufficient detail to determine the amount of carryover for each of the air toxics compounds. Experience has shown[3,9,15] that the present cleanup procedure is satisfactory so long as a period less than a week elapses between sampling and analysis.

A study needs to be conducted to determine the effects of:

- Additional pressurization/vacuum cycles on cleanup;
- Heating the canisters during cleanup;

- Vacuum holding time during cleanup; and
- Holding time between cleanup and sampling

on the carryover for each air toxics target compound.

The present canister cleanup procedure is described in Section 3.3.2 and consists of three vacuum/pressurization cycles with cleaned, dried air that has been humidified. These cycles are followed by a final vacuum step to 5 mm Hg vacuum. Preliminary measurements[15] have indicated that after this cleaning procedure has been completed, there may be sufficient organic compounds still adsorbed on the canister interior surfaces to be desorbed and measured in the 0.05 to 0.50 ppbv range, especially for long holding times.

9.3 SAMPLER CERTIFICATION

Blank and challenge certification of all samplers used to collect ambient air samples on which GC/MD analyses are to be performed should be continued. This certification ensures that the sampler is not changing the actual organic compound concentration of the ambient air being sampled, either by adding or removing target compounds.

9.4 REPLICATE AND DUPLICATE ANALYSES

In future studies, replicate analyses on the duplicate samples are recommended. In this way it would be possible to separate sampling precision from analytical precision.

10.0 REFERENCES

1. Compendium Method TO-12, "Determination of Non-Methane Organic Compounds (NMOC) in Ambient Air Using Cryogenic Pre-Concentration and Direct Flame Ionization Detection (PDFID)," Quality Assurance Division, Environmental Monitoring Systems Laboratory, U.S. Environmental Protection Agency, Research Triangle Park, NC, 27711, May 1988.

2. Radian Corporation. 1989 Nonmethane Organic Compound Monitoring and Three-Hour Urban Air Toxics Monitoring Programs, Work Plan and Quality Assurance Project Plan. DCN No. 88-262-045-67. Prepared for the U.S. Environmental Protection Agency, Research Triangle Park, NC. EPA Contract No. 68D80014, August 7, 1989.

3. McAllister, Robert A., Phyllis L. O'Hara, Wendy H. Moore, Dave-Paul Dayton, Joann Rice, Robert F. Jongleux, Raymond G. Merrill, Jr., Joan T. Bursey, "1988 Nonmethane Organic Compound and Urban Air Toxics Monitoring Program. Final Report. Volume I. Nonmethane Organic Compound and Three-Hour Air Toxics Monitoring Program." Radian Corporation, DCN No. 88-262-045-25. Prepared for Dr. Harold G. Richter, Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, NC, 27709. EPA Contract No. 68D80014, December 1988.

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8. Radian Corporation. Proposed Diurnal Nonmethane Organic Compound Sampling Plan. DCN No. 88-262-045-11. Prepared for U.S. Environmental Protection Agency, Research Triangle Park, NC. EPA Contract No. 68D80014. September 30, 1988.

9. McAllister, R. A., Radian Corporation. Letter and Proposal, entitled "Wet Zero Study", to Frank F. McElroy, Quality Assurance Division, Environmental Systems Monitoring Laboratory, U.S. Environmental Protection Agency, Research Triangle Park, NC. November 15, 1988.

10. Radian Corporation. Urban Air Toxics Monitoring Program. Third Quarterly Report. Second Quarter 1988. DCN No. 88-262-045-08. Prepared for Office of Air Quality Planning and Standards, U. S. Environmental Protection Agency, Research Triangle Park, NC. August 31, 1988.

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12. "1988 U.S. EPA Region III Nonmethane Organic Compound Monitoring," Maryland Department of the Environment, Air Management Administration, Baltimore, Maryland 21224.

13. "1987 U.S. EPA Region III Nonmethane Organic Compounds Monitoring," Maryland Department of the Environment, Air Management Administration, Baltimore, Maryland 21224 (November 16,1988

14. Telecon. Erdman, Ted, U.S. EPA Region III, with McAllister, R. A., Radian Corporation, June 19, 1989. Verification of AIRS Nos. for NMOC Monitoring Sites for Region III, 1987 and 1988 Programs. Discussed apparent problems with Arlington, VA, monitoring data.

15. McAllister, Robert A., Memorandum to Vinson L. Thompson, Frank F. McElroy, U.S. Environmental Protection Agency, AREAL, "Vince Thompson Canister Cleanup Study Results," dated July 10, 1989.

16. Compendium Method TO-14, "The Determination of Volatile Organic Compounds (VOCs) in Ambient Air Using SUMMA® Passivated Canister Sampling and Gas Chromatographic Analysis," Quality Assurance Division, Environmental Monitoring Systems Laboratory, U.S. Environmental Protection Agency, Research Triangle Park, NC 27711, May 1988.

APPENDICES

APPENDIX A: SAMPLING SITES FOR 1989 NMOC MONITORING PROGRAM

APPENDIX B: CRYOGENIC PRECONCENTRATION AND DIRECT FLAME IONIZATION DETECTION (PDFID) METHOD

APPENDIX C: 1989 NMOC MONITORING PROGRAM SITE DATA

APPENDIX D: 1989 NMOC MONITORING PROGRAM INVALIDATED AND MISSING SAMPLES

APPENDIX E: PDFID INTEGRATOR PROGRAMMING INSTRUCTIONS

APPENDIX F: 1989 NMOC DAILY CALIBRATION DATA

APPENDIX G: 1989 NMOC IN-HOUSE QUALITY CONTROL SAMPLES

APPENDIX H: MULTIPLE DETECTOR SPECIATED THREE-HOUR SITE DATA SUMMARIES

TABLE A-1. 1989 NMOC AND THREE-HOUR AIR TOXICS MONITORING PROGRAM SITES.

Site No.	U.S. EPA Region	City	Radian Site Code	SAROAD Number	AIRS Number	3-Hr Air Toxics
1	II	New York, NY (Mabel Dean)	MNY	33-4680-059	36-061-0010	Yes
2		New York, NY (P.S. 59)	MINY	33-4680-056	36-061-0056	Yes
3		Newark, NJ (St. Charles St)	NWNJ	31-3480-011	34-013-0011	Yes
4		Plainfield, NJ (W 3rd and E Bergan)	PLNJ	31-4300-001	34-035-1001	Yes
5	IV	Montgomery, AL (Dickinson Dr)	MGAL		01-101-0008	No
6		Lexington, KY	LXKY	18-2300-012	21-067-0012	No
7		Raleigh, NC (E. Millbrook)	RLNC	32-4000-014	37-183-0014	No
8	V	Chicago, IL (90th Floor Sears)	C3IL	14-1220-042	17-031-0042	Yes
9		Chicago, IL (CTA Franklin)	C6IL	14-1220-063	17-031-0063	Yes
10		Grand Rapids, MI (Monroe, NW)	GRMI	23-1820-020	26-081-0020	Yes
11	VI	Dallas, TX (Hinton St)	DLTX	45-1310-069	48-113-0069	No
12		El Paso, TX (Rim Road)	ELTX	45-1700-037	48-141-0037	No
13		Beaumont, TX (Lamar U)	BMTX	45-0030-009	48-245-0009	No
14		Houston, TX (Mae Dr)	HITX	45-2560-034	48-201-1034	No
15	VII	St. Louis, MO (Clark St Parking)	S2MO	26-4280-072	29-510-0072	No
16	IX	Alpine, CA (W. Victoria Dr)	ALCA	05-6820-006	06-073-1006	No
17		El Cajon, CA (Redwood Ave)	ELCA	05-2220-003	06-073-0003	No
18		Long Beach, CA (N L.B. Blvd)	LBCA	05-4100-002	06-037-4002	No
19		Reseda, CA (Gault St)	RSCA	05-4200-001	06-037-1201	No
20		Sacramento, CA (1309 T St)	S3CA	[a]	06-067-0010	No
21		Sacramento, CA (Sac-Del Paso)	S4CA	05-6580-006	06-067-0006	No
22		Fremont, CA (Chapel Way)	FECA	05-2780-001	06-001-1001	No
23		Bakersfield, CA (Chester Ave)	BACA	05-0520-004	06-029-0004	No

[a] SAROAD number has not been assigned to this site.

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DATE  11/02/89                EPA AEROMETRIC INFORMATION RETRIEVAL SYSTEM (AIRS)
AMP380                                       AIR QUALITY SUBSYSTEM
                                         SITE DESCRIPTION INVENTORY

EPA REGION: 09                             STATE (06): CALIFORNIA


SITE ID          : 06-001-1001 CITY (26000): FREMONT                     LATITUDE :  37:32:08 N  UTM EASTING          :   591812
CITY POPULATION :     131,945  COUNTY (001): ALAMEDA CO                  LONGITUDE: 121:57:39 W  DIFF. GMT            : 08
AQCR POPULATION :  5,179,784  AQCR   (030): SAN FRANCISCO BAY AREA       UTM ZONE : 10           ELEVATION ABOVE MSL:     24 M
DATE ESTABLISHED:   /  /      LAND USE (1): RESIDENTIAL                  UTM NORTHING: 4154589   RECORD LAST UPDATED: 89/10/26
DATE TERMINATED :   /  /      LOCATION SETTING (2): SUBURBAN             HQ EVAL DATE:   /  /    LAST REQ EVAL        : 80/01/12
SITE ADDR: 40733 CHAPEL WAY., FREMONT                                    DISTANCE CITY:          COMPASS SECTOR       :
URBAN AREA (7400): SAN JOSE, CA                                          HC IND:                 MET DATA             : N
SUPPORTING AGENCY (004): BAY AREA AIR QUALITY MANAGEMENT DISTRICT        MSA (5775): OAKLAND, CA
COMMENTS: ARB CODE NO 60-336  ACTIVE 8-70
SITE-USER-INFO: NO2 DATA FROM THIS SITE BEFORE 1/1/80 HAVE A POSITIVE BIAS OF 14%.

PARAMETER     : 43102        ATTAIN-STATUS   :             SAMPLING-BEGAN  : 88/06/10        DOMINANT-SOURCE  :
POC           : 1            ANALYZ-LAB      : 908         SAMPLING-ENDED  :   /  /          MEAS-SCALE       :
MONITOR-TYPE  : 3            COLLECT-LAB     : 908         AUDIT-DATE      :   /  /          MONITORING-OBJ   :
MT-EFF-DATE   : 88/06/10     REPORT-ORG      :             DAYS-EXCLUDED   :                 SITING-CRITERIA  :
REF-METHOD    :              RO-EFFECT-DATE  :   /  /      PROJECT-CLASS   :                 SITING-CRIT-DATE :   /  /
REF-METH-DATE :   /  /                                     ACT-TAKEN/REASON:      /          PROBE-HEIGHT     :
MONITOR-COMMENTS : SPECIAL STUDY OF NON-METHANE ORGANIC COMPOUND

PARAMETER     : 43102        ATTAIN-STATUS   :             SAMPLING-BEGAN  : 88/06/13        DOMINANT-SOURCE  :
POC           : 2            ANALYZ-LAB      : 908         SAMPLING ENDED  :   /  /          MEAS-SCALE       :
MONITOR-TYPE  : 3            COLLECT-LAB     : 908         AUDIT-DATE      :   /  /          MONITORING-OBJ   :
MT-EFF-DATE   : 88/06/13     REPORT-ORG      :             DAYS-EXCLUDED   :                 SITING-CRITERIA  :
REF-METHOD    :              RO-EFFECT-DATE  :   /  /      PROJECT-CLASS   :                 SITING-CRIT-DATE :   /  /
REF METH-DATE :   /  /                                     ACT-TAKEN/REASON:      /          PROBE-HEIGHT     :
MONITOR-COMMENTS : NON-METHANE ORGANIC COMPOUND SAME DAY/CANISTER AS POC1

PARAMETER     : 43102        ATTAIN-STATUS   :             SAMPLING-BEGAN  : 88/06/23        DOMINANT-SOURCE  :
POC           : 3            ANALYZ-LAB      : 908         SAMPLING-ENDED  :   /  /          MEAS-SCALE       :
MONITOR-TYPE  : 3            COLLECT-LAB     : 908         AUDIT-DATE      :   /  /          MONITORING-OBJ   :
MT-EFF-DATE   : 88/06/23     REPORT ORG      :             DAYS-EXCLUDED   :                 SITING-CRITERIA  :
REF-METHOD    :              RO-EFFECT-DATE  :   /  /      PROJECT-CLASS   :                 SITING-CRIT-DATE :   /  /
REF-METH-DATE :   /  /                                     ACT-TAKEN/REASON:      /          PROBE-HEIGHT     :
MONITOR-COMMENTS : NON-METHANE ORGANIC COMPOUND SAME DAY DIFFERENT CANISTER AS 1


SITE ID          : 06-029-0004 CITY     26): BAKERSFIELD                 LATITUDE :   5:22:30 N  UTM EASTING          :   316348
CITY POPULATION :     105,735  COUNTY (029): KERN CO                     LONGITUDE: 119:01:18 W  DIFF. GMT            : 08
AQCR POPULATION :  2,082,850  AQCR   (031): SAN JOAQUIN VALLEY           UTM ZONE : 11           ELEVATION ABOVE MSL:    137 M
DATE ESTABLISHED:   /  /      LAND USE (1): RESIDENTIAL                  UTM NORTHING: 3916308   RECORD LAST UPDATED: 89/10/30
DATE TERMINATED :   /  /      LOCATION SETTING (1): URBAN AND CENTER CITY  HQ EVAL DATE:   /  /  LAST REQ EVAL        : 80/07/01
SITE ADDR: ROOM 309, 225 CHESTER AVE., BAKERSFIELD                       DISTANCE CITY:          COMPASS SECTOR       :
URBAN AREA (0680): BAKERSFIELD, CA                                       HC IND:                 MET DATA             :
SUPPORTING AGENCY (001): CALIFORNIA AIR RESOURCES BOARD                  MSA (0680): BAKERSFIELD,CA
COMMENTS: ARB #1500203 ACTIVE 6-71. CONTAINS DATA FROM 003F01 PER [illegible] & RL.
SITE-USER-INFO: NO2 DATA FROM THIS SITE BEFORE 1/1    HAVE A POSITIVE BIAS OF 16
```

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DATE  11/02/89                    EPA AEROMETRIC INFORMATION RETRIEVAL SYSTEM (AIRS)
AMP380                                         AIR QUALITY SUBSYSTEM
                                             SITE DESCRIPTION INVENTORY

                                               STATE (06): CALIFORNIA
EPA REGION: 09

SITE-ID: 06-029-0004

                                                         SAMPLING BEGAN  : 87/07/17         DOMINANT-SOURCE  :
PARAMETER      : 43102       ATTAIN-STATUS  :            SAMPLING-ENDED  :   / /            MEAS-SCALE       :
POC            : 1           ANALYZ-LAB     : 908        AUDIT-DATE      :   / /            MONITORING-OBJ   :
MONITOR-TYPE   : 3           COLLECT-LAB    : 908        DAYS-EXCLUDED   :                  SITING-CRITERIA  :
MI-EFF-DATE    : 87/07/17    REPORT-ORG     :            PROJECT-CLASS   :                  SITING-CRIT-DATE :   / /
REF-METHOD     :             RO-EFFECT-DATE :   / /      ACT-TAKEN/REASON:      /           PROBE-HEIGHT     :
REF-METH-DATE :   / /
MONITOR-COMMENTS : SPECIAL STUDY OF NON METHANE ORGANIC COMPOUND
                                                         SAMPLING BEGAN  : 87/07/29         DOMINANT-SOURCE  :
PARAMETER      : 43102       ATTAIN-STATUS  :            SAMPLING-ENDED  :   / /            MEAS-SCALE       :
POC            : 2           ANALYZ-LAB     : 908        AUDIT-DATE      :   / /            MONITORING-OBJ   :
MONITOR-TYPE   : 3           COLLECT-LAB    : 908        DAYS-EXCLUDED   :                  SITING-CRITERIA  :
MI-EFF-DATE    : 87/07/29    REPORT-ORG     :            PROJECT-CLASS   :                  SITING-CRIT-DATE :   / /
REF-METHOD     :             RO-EFFECT-DATE :   / /      ACT-TAKEN/REASON:      /           PROBE-HEIGHT     :
REF-METH-DATE :   / /
MONITOR-COMMENTS : NON-METHANE ORGANIC COMPOUND SAME DAY/CANISTER AS POC1
                                                         SAMPLING BEGAN  : 87/08/13         DOMINANT-SOURCE  :
PARAMETER      : 43102       ATTAIN-STATUS  :            SAMPLING-ENDED  :   / /            MEAS-SCALE       :
POC            : 3           ANALYZ-LAB     : 908        AUDIT-DATE      :   / /            MONITORING-OBJ   :
MONITOR-TYPE   : 3           COLLECT-LAB    : 908        DAYS-EXCLUDED   :                  SITING-CRITERIA  :
MI-EFF-DATE    : 87/08/13    REPORT-ORG     :            PROJECT-CLASS   :                  SITING-CRIT-DATE :   / /
REF-METHOD     :             RO-EFFECT-DATE :   / /      ACT-TAKEN/REASON:      /           PROBE-HEIGHT     :
REF-METH-DATE :   / /
MONITOR-COMMENTS : NON METHANE ORGANIC COMPOUND SAME DAY DIFFERENT CANISTER AS 1

                                                                 LATITUDE :  33:49:25 N  UTM EASTING          :   390002
SITE ID          : 06-037-4002 CITY (43000): LONG BEACH          LONGITUDE: 118:11:19 W  DIFF. GMT            : 08
CITY POPULATION :     361,334  COUNTY (037): LOS ANGELES CO      UTM ZONE : 11           ELEVATION ABOVE MSL:      6 M
AQCR POPULATION : 11,201,922   AQCR   (024): METROPOLITAN LOS ANGELES  UTM NORTHING: 3743040   RECORD LAST UPDATED: 89/10/19
DATE ESTABLISHED:   / /        LAND USE (1): RESIDENTIAL         MQ EVAL DATE:   / /     LAST REQ EVAL        : 80/02/28
DATE TERMINATED :   / /        LOCATION SETTING (2): SUBURBAN    DISTANCE CITY:          COMPASS SECTOR       :
SITE ADDR: 3648 N. LONG BEACH BLVD., LONG BEACH                  NC IND:                 MET DATA      '      : N
URBAN AREA (4480): LOS ANGELES-LONG BEACH, CA                    MSA (4480): LOS ANGELES-LONG BEACH, CA
SUPPORTING AGENCY (061): SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
COMMENTS: NEAN /EMSL TRACE METALS SITE
SITE USER-INFO: NO2 DATA FROM THIS SITE BEFORE 1/1/80 HAVE A POSITIVE BIAS OF 14%.
                                                         SAMPLING BEGAN  : 78/01/01         DOMINANT-SOURCE  :
PARAMETER      : 43102       ATTAIN-STATUS  :            SAMPLING ENDED  :   / /            MEAS-SCALE       :
POC            : 1           ANALYZ LAB     :            AUDIT-DATE      :   / /            MONITORING-OBJ   :
MONITOR-TYPE   : 0           COLLECT-LAB    :            DAYS-EXCLUDED   :                  SITING CRITERIA  :
MI EFF-DATE    : 78/01/01    REPORT-ORG     :            PROJECT-CLASS   : 01               SITING CRIT-DATE :   / /
REF-METHOD     :             RO EFFECT-DATE :   / /      ACT-TAKEN/REASON:      /           PROBE-HEIGHT     :   6 M
REF METH-DATE :   / /
MONITOR-COMMENTS : 11
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DATE  11/02/89                         EPA AEROMETRIC INFORMATION RETRIEVAL SYSTEM (AIRS)
AMP380                                             AIR QUALITY SUBSYSTEM
                                               SITE DESCRIPTION INVENTORY

EPA REGION: 09                                     STATE (06): CALIFORNIA


SITE ID          : 06-073-0003 CITY (21712): EL CAJON                          LATITUDE :  32:47:29 N  UTM EASTING          :   505462
CITY POPULATION :      73,892  COUNTY (073): SAN DIEGO CO                      LONGITUDE: 116:56:30 W  DIFF. GMT            : 08
AQCR POPULATION :  1,859,655  AQCR   (029): SAN DIEGO                          UTM ZONE : 11           ELEVATION ABOVE MSL:   143 M
DATE ESTABLISHED:   / /        LAND USE (2): COMMERCIAL                        UTM NORTHING: 3627972   RECORD LAST UPDATED: 89/10/26
DATE TERMINATED :   / /        LOCATION SETTING (2): SUBURBAN                  HQ EVAL DATE:   / /     LAST REQ EVAL        : 80/01/28
SITE ADDR: 1155 REDWOOD AVE., EL CAJON                                         DISTANCE CITY:          COMPASS SECTOR       :
URBAN AREA (7320): SAN DIEGO, CA                                               MC IND:                 MET DATA             : N
SUPPORTING AGENCY (036): SAN DIEGO COUNTY AIR QUALITY MANAGEMENT DISTRICT     MSA (7320): SAN DIEGO, CA
COMMENTS: ARB SITE NUMBER 8000131  NEW SITE  12-81

PARAMETER      : 43102          ATTAIN STATUS  :                SAMPLING-BEGAN  : 87/06/01          DOMINANT-SOURCE  :
POC            : 1              ANALYZ-LAB     : 908            SAMPLING-ENDED  :   / /             MEAS-SCALE       :
MONITOR-TYPE   : 3              COLLECT-LAB    : 908            AUDIT-DATE      :   / /             MONITORING-OBJ   :
MT-EFF-DATE    : 87/06/01       REPORT-ORG     :                DAYS-EXCLUDED   :                   SITING-CRITERIA  :
REF-METHOD     :                RO-EFFECT-DATE :   / /          PROJECT-CLASS   :                   SITING-CRIT-DATE :   / /
REF-METH-DATE :   / /                                           ACT-TAKEN/REASON:     /             PROBE-HEIGHT     :
MONITOR-COMMENTS : SPECIAL STUDY OF NON-METHANE ORGANIC COMPOUND

PARAMETER      : 43102          ATTAIN-STATUS  :                SAMPLING-BEGAN  : 87/06/03          DOMINANT-SOURCE  :
POC            : 2              ANALYZ-LAB     : 908            SAMPLING-ENDED  :   / /             MEAS-SCALE       :
MONITOR-TYPE   : 3              COLLECT-LAB    : 908            AUDIT-DATE      :   / /             MONITORING-OBJ   :
MT-EFF-DATE    : 87/06/03       REPORT-ORG     :                DAYS-EXCLUDED   :                   SITING-CRITERIA  :
REF-METHOD     :                RO-EFFECT-DATE :   / /          PROJECT-CLASS   :                   SITING-CRIT-DATE :   / /
REF-METH-DATE :   / /                                           ACT-TAKEN/REASON:     /             PROBE-HEIGHT     :
MONITOR-COMMENTS : NON METHANE ORGANIC COMPOUND SAME DAY/CANISTER AS POC1

PARAMETER      : 43102          ATTAIN-STATUS  :                SAMPLING-BEGAN  : 87/06/11          DOMINANT-SOURCE  :
POC            : 3              ANALYZ-LAB     : 908            SAMPLING-ENDED  :   / /             MEAS-SCALE       :
MONITOR-TYPE   : 3              COLLECT-LAB    : 908            AUDIT-DATE      :   / /             MONITORING-OBJ   :
MT-EFF-DATE    : 87/06/11       REPORT-ORG     :                DAYS-EXCLUDED   :                   SITING-CRITERIA  :
REF-METHOD     :                RO-EFFECT-DATE :   / /          PROJECT-CLASS   :                   SITING-CRIT-DATE :   / /
REF-METH-DATE :   / /                                           ACT-TAKEN/REASON:     /             PROBE-HEIGHT     :
MONITOR-COMMENTS : NON METHANE ORGANIC COMPOUND SAME DAY DIFFERENT CANISTER    1
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DATE  11/03/89                          EPA AEROMETRIC INFORMATION RETRIEVAL SYSTEM (AIRS)
AMP380                                              AIR QUALITY SUBSYSTEM
                                                 SITE DESCRIPTION INVENTORY

                                                   STATE (06): CALIFORNIA
EPA REGION: 09


                                                                         LATITUDE :  34:11:58 N  UTM EASTING          :   358722
SITE ID          : 06-037-1201 CITY (00000): NOT IN A CITY               LONGITUDE: 118:32:00 W  DIFF. GMT            : 08
CITY POPULATION :            1  COUNTY (037): LOS ANGELES CO             UTM ZONE : 11           ELEVATION ABOVE MSL:   226 M
AQCR POPULATION : 11,201,922  AQCR   (024): METROPOLITAN LOS ANGELES     UTM NORTHING: 3785137   RECORD LAST UPDATED: 88/07/28
DATE ESTABLISHED:   /  /        LAND USE (2): COMMERCIAL                 HQ EVAL DATE:   /  /    LAST REQ EVAL        :   /  /
DATE TERMINATED :   /  /        LOCATION SETTING (2): SUBURBAN           DISTANCE CITY:          COMPASS SECTOR       :
SITE ADDR: 18330 GAULT ST., RESEDA                                       HC IND:                 MET DATA             :
URBAN AREA (0000): NOT IN AN URBAN AREA                                  MSA (4480): LOS ANGELES-LONG BEACH, CA
SUPPORTING AGENCY (000): ************** DESCRIPTION UNKNOWN **************
COMMENTS: ARB SITE NUMBER 70000741 EMERGENCY EPISODE MONITOR
SITE-USER-INFO: NO2 DATA FROM THIS SITE BEFORE 1/1/80 HAVE A POSITIVE BIAS OF 14%.

                                                                         LATITUDE :  38:36:50 N  UTM EASTING          :   642206
SITE ID          : 06-067-0006 CITY (64000): SACRAMENTO                  LONGITUDE: 121:22:00 W  DIFF. GMT            : 08
CITY POPULATION :      275,741  COUNTY (067): SACRAMENTO CO              UTM ZONE : 10           ELEVATION ABOVE MSL:     8 M
AQCR POPULATION :  1,598,583  AQCR   (028): SACRAMENTO VALLEY            UTM NORTHING: 4274988   RECORD LAST UPDATED: 89/10/05
DATE ESTABLISHED:   /  /        LAND USE (1): RESIDENTIAL                HQ EVAL DATE:   /  /    LAST REQ EVAL        :   /  /
DATE TERMINATED :   /  /        LOCATION SETTING (2): SUBURBAN           DISTANCE CITY:          COMPASS SECTOR       :
SITE ADDR: 2701 AVALON DR., SACRAMENTO                                   HC IND:                 MET DATA             :
URBAN AREA (6920): SACRAMENTO, CA                                        MSA (6920): SACRAMENTO, CA
SUPPORTING AGENCY (000): ************** DESCRIPTION UNKNOWN **************
COMMENTS: ARB SITE NUMBER 3400295  COMMENCED OPERATOIN 12-20-79 IN LITTLE
SITE-USER-INFO: LEAGUE SNACK SHACK

                                                                         LATITUDE :  32:50:00 N  UTM EASTING          :   523398
SITE ID          : 06-073-1006 CITY (00000): NOT IN A CITY               LONGITUDE: 116:45:00 W  DIFF. GMT            : 08
CITY POPULATION :            1  COUNTY (073): SAN DIEGO CO               UTM ZONE : 11           ELEVATION ABOVE MSL:   603 M
AQCR POPULATION :  1,859,655  AQCR   (029): SAN DIEGO                    UTM NORTHING: 3632647   RECORD LAST UPDATED: 87/10/01
DATE ESTABLISHED:   /  /        LAND USE (1): RESIDENTIAL                HQ EVAL DATE:   /  /    LAST REQ EVAL        :   /  /
DATE TERMINATED :   /  /        LOCATION SETTING (3): RURAL              DISTANCE CITY:          COMPASS SECTOR       :
SITE ADDR: 2300 VICTORIA DR., ALPINE                                     HC IND:                 MET DATA             :
URBAN AREA (0000): NOT IN AN URBAN AREA                                  MSA (7320): SAN DIEGO, CA
SUPPORTING AGENCY (000): ************** DESCRIPTION UNKNOWN **************
COMMENTS: ARB SITE NUMBER 8000128 - START 1-77.
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DATE  11/03/89                          EPA AEROMETRIC INFORMATION RETRIEVAL SYSTEM (AIRS)
AMP380                                              AIR QUALITY SUBSYSTEM
                                                 SITE DESCRIPTION INVENTORY

EPA REGION                                          STATE (17): ILLINOIS




SITE ID          : 17-031-0063 CITY (14000)                            LATITUDE :  41:52:38 N  UTM EASTING          :   447365
CITY POPULATION :  3,005,072  COUNTY (031)                             LONGITUDE:  87:38:04 W  DIFF. GMT            :
AQCR POPULATION :  7,917,109  AQCR   (067)     METROPOLITAN CHICAGO    UTM ZONE : 16           ELEVATION ABOVE MSL:    181 M
DATE ESTABLISHED: 88/06/24    LAND USE (7): MOBILE                     UTM NORTHING: 4636096   RECORD LAST UPDATED: 89/08/10
DATE TERMINATED :   /  /      LOCATION SETTING (1): URBAN AND CENTER CITY  MQ EVAL DATE:  /  /   LAST REQ EVAL        :   /  /
SITE ADDR: CTA BUILDING, 320 S. MICHIGAN                               DISTANCE CITY:          COMPASS SECTOR       :
URBAN AREA (1601): CHICAGO, IL-NORTHWESTERN IN                         MC IND: Y               MET DATA             :
SUPPORTING AGENCY (001): ILLINOIS ENVIRONMENTAL PROTECTION AGENCY      MSA (1600): CHICAGO, IL
COMMENTS:
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DATE  11/02/89                              EPA AEROMETRIC INFORMATION RETRIEVAL SYSTEM (AIRS)
AMP380                                                    AIR QUALITY SUBSYSTEM
                                                        SITE DESCRIPTION INVENTORY

EPA REGION: 05                                              STATE (17): ILLINOIS


SITE ID          : 17-031-0042 CITY (14000): CHICAGO                              LATITUDE :  41:52:43 N  UTM EASTING          :   447200
CITY POPULATION :  3,005,072  COUNTY (031): COOK CO                               LONGITUDE:  87:38:11 W  DIFF. GMT            : 06
AQCR POPULATION :  7,917,109  AQCR   (067): METROPOLITAN CHICAGO                  UTM ZONE : 16           ELEVATION ABOVE MSL:
DATE ESTABLISHED:   /  /      LAND USE (2): COMMERCIAL                            UTM NORTHING: 4636300   RECORD LAST UPDATED: 89/10/26
DATE TERMINATED :   /  /      LOCATION SETTING (1): URBAN AND CENTER CITY         MQ EVAL DATE:   /  /    LAST REQ EVAL      :   /  /
SITE ADDR: WACKER AT ADAMS, SEARS TOWER                                           DISTANCE CITY:          COMPASS SECTOR     :
URBAN AREA (1601): CHICAGO, IL-NORTHWESTERN IN                                    MC IND:                 MET DATA           :
SUPPORTING AGENCY (001): ILLINOIS ENVIRONMENTAL PROTECTION AGENCY                 MSA (1600): CHICAGO, IL
COMMENTS:

PARAMETER      : 43102          ATTAIN STATUS  :            SAMPLING BEGAN  : 87/06/01          DOMINANT-SOURCE  :
POC            : 1              ANALYZ-LAB     : 908        SAMPLING ENDED  :   /  /            MEAS-SCALE       :
MONITOR-TYPE   : 3              COLLECT-LAB    : 908        AUDIT-DATE      :   /  /            MONITORING-OBJ   :
MT EFF-DATE    : 87/06/01       REPORT-ORG     :            DAYS-EXCLUDED   :                   SITING-CRITERIA  :
REF-METHOD     :                RO-EFFECT-DATE :   /  /     PROJECT-CLASS   :                   SITING-CRIT-DATE :   /  /
REF METH-DATE  :   /  /                                     ACT-TAKEN/REASON:      /            PROBE-HEIGHT     :
MONITOR-COMMENTS : SPECIAL STUDY OF NON METHANE ORGANIC COMPOUND

PARAMETER      : 43102          ATTAIN STATUS  :            SAMPLING BEGAN  : 87/06/04          DOMINANT-SOURCE  :
POC            : 2              ANALYZ-LAB     : 908        SAMPLING ENDED  :   /  /            MEAS-SCALE       :
MONITOR-TYPE   : 3              COLLECT-LAB    : 908        AUDIT-DATE      :   /  /            MONITORING OBJ   :
MT EFF-DATE    : 87/06/04       REPORT-ORG     :            DAYS-EXCLUDED   :                   SITING-CRITERIA  :
REF METHOD     :                RO-EFFECT-DATE :   /  /     PROJECT-CLASS   :                   SITING CRIT-DATE :   /  /
REF METH-DATE  :   /  /                                     ACT-TAKEN/REASON:      /            PROBE-HEIGHT     :
MONITOR-COMMENTS : NON METHANE ORGANIC COMPOUND SAME DAY/CANISTER AS POC1

PARAMETER      : 43102          ATTAIN STATUS  :            SAMPLING BEGAN  : 87/06/16          DOMINANT-SOURCE  :
POC            : 3              ANALYZ LAB     : 908        SAMPLING-ENDED  :   /  /            MEAS-SCALE       :
MONITOR-TYPE   : 3              COLLECT-LAB    : 908        AUDIT-DATE      :   /  /            MONITORING-OBJ   :
MT-EFF-DATE    : 87/06/16       REPORT ORG     :            DAYS-EXCLUDED   :                   SITING CRITERIA  :
REF METHOD     :                RO-EFFECT-DATE :   /  /     PROJECT-CLASS   :                   SITING CRIT-DATE :   /  /
REF METH-DATE  :   /  /                                     ACT-TAKEN REASON:      /            PROBE HEIGHT     :
MONITOR-COMMENTS : NON METHANE ORGANIC COMPOUND SAME DAY DIFFERENT CANISTER AS 1
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DATE  11/02/89                    EPA AEROMETRIC INFORMATION RETRIEVAL SYSTEM (AIRS)
AMP380                                        AIR QUALITY SUBSYSTEM
                                           SITE DESCRIPTION INVENTORY

EPA REGION: 05                                 STATE (26): MICHIGAN


                                                                                                    .
                                                                    LATITUDE :  42:59:05 N  UTM EASTING         :   608500
SITE ID          : 26 081-0020 CITY (34000): GRAND RAPIDS           LONGITUDE:  85:40:18 W  DIFF. GMT           : 05
CITY POPULATION :     181,843  COUNTY (081): KENT CO                UTM ZONE : 16           ELEVATION ABOVE MSL:   186 M
AQCR POPULATION :  2,448,634  AQCR   (122): CENTRAL MICHIGAN        UTM NORTHING: 4759750   RECORD LAST UPDATED: 89/11/02
DATE ESTABLISHED: 80/04/24    LAND USE (3): INDUSTRIAL              HQ EVAL DATE:   /  /    LAST REQ EVAL       :   /  /
DATE TERMINATED :   /  /      LOCATION SETTING (1): URBAN AND CENTER CITY   DISTANCE CITY:  COMPASS SECTOR      :
SITE ADDR: 1179 MONROE NW                                           HC IND:                 MET DATA            :
URBAN AREA (3000): GRAND RAPIDS, MI                                 MSA (3000): GRAND RAPIDS, MI
SUPPORTING AGENCY (006): GRAND RAPIDS DEPARTMENT OF AIR POLLUTION
COMMENTS: STARTED 4/80. NO2 DISCONTINUED 12/80.
SITE-USER-INFO: CONTINUOUS MONITOR INLETS AT 15 FT.

PARAMETER      : 43102         METHOD         :           SAMPLING-BEGAN  : 89/06/05      DOMINANT-SOURCE  :
POC            : 1              ANLYZ-LAB     : 908       SAMPLING-ENDED  : 89/09/30      MEAS-SCALE       :
MONITOR-TYPE   : 3             COLLECT-LAB    : 006       AUDIT-DATE      :               MONITORING-OBJ   : 2
NM-EFF-DATE    : 89/06/05      REPORT-ORG     : 908       DAYS-EXCLUDED   :               SITING-CRITERIA  :
REF-METHOD     :               RO-EFFECT-DATE : 89/06/05  PROJECT-CLASS   :               SITING CRIT-DATE :   /  /
REF-METH-DATE :   /  /                                    ACT-TAKEN/REASON:      /        PROBE-HEIGHT     :    5 M
MONITOR-COMMENTS : OPERATED SUMMER '89 FOR O3 STUDY
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DATE  11/02/89                         EPA AEROMETRIC INFORMATION RETRIEVAL SYSTEM (AIRS)
AMP390                                              AIR QUALITY SUBSYSTEM
                                                 SITE DESCRIPTION INVENTORY

EPA REGION: 02                                      STATE (34): NEW JERSEY


SITE ID          : 34-013-0011 CITY (51000): NEWARK                        LATITUDE :  40:43:37 N  UTM EASTING          :   572280
CITY POPULATION :     329,248  COUNTY (013): ESSEX CO                      LONGITUDE:  74:08:39 W  DIFF. GMT            : 05
AQCR POPULATION : 16,525,701  AQCR   (043): NEW JERSEY-NEW YORK-CONNECTICU UTM ZONE : 18          ELEVATION ABOVE MSL:      3 M
DATE ESTABLISHED: 85/01/01     LAND USE (3): INDUSTRIAL                    UTM NORTHING: 4508570   RECORD LAST UPDATED: 89/10/26
DATE TERMINATED :   /  /       LOCATION SETTING (1): URBAN AND CENTER CITY HQ EVAL DATE:   /  /    LAST REQ EVAL        : 86/05/06
SITE ADDR: ST. CHARLES BETWEEN KOSSUTH & KAMERON ST                        DISTANCE CITY: 015      COMPASS SECTOR       : SW
URBAN AREA (5601): NEW YORK, NE-NORTHEASTERN NJ                            MC IND: Y               MET DATA             : N
SUPPORTING AGENCY (001): NEW JERSEY STATE DEPARTMENT OF ENVIRONMENTAL PROTEC MSA (5640): NEWARK, NJ
COMMENTS: NJ #07142,START 1/1/85,RELOC.FROM 340130008. SITING CRITERIA?
SITE-USER-INFO: PMIO,DICHOT,START 3/15/86,ELEV.16';03 DOWN 5/16/86-3/25/87

PARAMETER     : 43102         ATTAIN STATUS  :            SAMPLING-BEGAN  : 86/06/02       DOMINANT-SOURCE  :
POC           : 1             ANALYZ LAB     : 908        SAMPLING ENDED  :   /  /         MEAS-SCALE       :
MONITOR-TYPE  : 3             COLLECT-LAB    : 908        AUDIT-DATE      :   /  /         MONITORING OBJ   :
MT EFF-DATE   : 86/06/02      REPORT-ORG     :            DAYS-EXCLUDED   :                SITING-CRITERIA  :
REF METHOD    :               RO-EFFECT-DATE :   /  /     PROJECT-CLASS   :                SITING CRIT-DATE :   /  /
REF METH-DATE :   /  /                                    ACT-TAKEN/REASON:     /          PROBE-HEIGHT     :
MONITOR-COMMENTS : SPECIAL STUDY OF NON METHANE ORGANIC COMPOUND

PARAMETER     : 43102         ATTAIN STATUS  :            SAMPLING BEGAN  : 86/06/19       DOMINANT-SOURCE  :
POC           : 2             ANALYZ-LAB     : 908        SAMPLING-ENDED  :   /  /         MEAS-SCALE       :
MONITOR-TYPE  : 3             COLLECT-LAB    : 908        AUDIT-DATE      :   /  /         MONITORING-OBJ   :
MT EFF-DATE   : 86/06/19      REPORT-ORG     :            DAYS-EXCLUDED   :                SITING-CRITERIA  :
REF-METHOD    :               RO-EFFECT-DATE :   /  /     PROJECT-CLASS   :                SITING CRIT-DATE :   /  /
REF METH-DATE :   /  /                                    ACT-TAKEN/REASON:     /          PROBE-HEIGHT     :
MONITOR-COMMENTS : NON METHANE ORGANIC COMPOUND SAME DAY/CANISTER AS POC1

PARAMETER     : 43102         ATTAIN-STATUS  :            SAMPLING BEGAN  : 86/06/06       DOMINANT-SOURCE  :
POC           : 3             ANALYZ LAB     : 908        SAMPLING-ENDED  :   /  /         MEAS-SCALE       :
MONITOR-TYPE  : 3             COLLECT-LAB    : 908        AUDIT-DATE      :   /  /         MONITORING-OBJ   :
MT EFF-DATE   : 86/06/06      REPORT-ORG     :            DAYS-EXCLUDED   :                SITING-CRITERIA  :
REF METHOD    :               RO EFFECT-DATE :   /  /     PROJECT-CLASS   :                SITING CRIT-DATE :   /  /
REF METH-DATE :   /  /                                    ACT-TAKEN/REASON:     /          PROBE-HEIGHT     :   /


SITE ID          : 34-035 1001 CITY (59190): PLAINFIELD                    LATITUDE :  40:36:04 N  UTM EASTING          :   547218
CITY POPULATION :      45,555  COUNTY (035): SOMERSET CO                   LONGITUDE:  74:26:31 W  DIFF. GMT            : 05
AQCR POPULATION : 16,525,701  AQCR   (043): NEW JERSEY-NEW YORK-CONNECTICU UTM ZONE : 18          ELEVATION ABOVE MSL:     18 M
DATE ESTABLISHED:   /  /       LAND USE (1): RESIDENTIAL                   UTM NORTHING: 4494399   RECORD LAST UPDATED: 89/10/26
DATE TERMINATED :   /  /       LOCATION SETTING (2): SUBURBAN              HQ EVAL DATE:   /  /    LAST REQ EVAL        :   /  /
SITE ADDR: WEST THIRD AND BERGEN STREETS                                   DISTANCE CITY:          COMPASS SECTOR       :
URBAN AREA (0000): NOT IN AN URBAN AREA                                    MC IND:                 MET DATA             :
SUPPORTING AGENCY (000): *************** DESCRIPTION UNKNOWN *************** MSA (5015): MIDDLESEX SOMERSET-HUNTERDON, NJ
COMMENTS: NJ #20121,START 5/80; 1980 NE OXIDANT STUDY,O3,NOX;SO2 DISC.5/2/83
SITE USER-INFO: 03 AS A SLAMS 10/01/84, MEETS SITING
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DATE  11/02/89                         EPA AEROMETRIC INFORMATION RETRIEVAL SYSTEM (AIRS)
AMP380                                               AIR QUALITY SUBSYSTEM
                                                  SITE DESCRIPTION INVENTORY

EPA REGION: 02                                        STA[illegible]61: NEW YORK


SITE ID          : 36-061-0010 CITY (51000): NEW YORK CITY                  LATITUDE :  40:44:[illegible] N  UTM EASTING         :   585607
CITY POPULATION :  7,071,639  COUNTY (061): NEW YORK CO                    LONGITUDE:  7[illegible]      W  DIFF. GMT           : 05
AQCR POPULATION : 16,525,701  AQCR   (043): NEW JERSEY-NEW YORK-CONNECTICU  UTM ZONE : 18                  ELEVATION ABOVE MSL:    38 M
DATE ESTABLISHED:   /  /      LAND USE (1): RESIDENTIAL                    UTM NORTHING: 4510116          RECORD LAST UPDATED: 89/10/26
DATE TERMINATED :   /  /      LOCATION SETTI[illegible] (1): URBAN AND CENTER CITY   HQ EVAL DATE: 80/09/23  LAST RLQ EVAL       : 80/09/22
SITE ADDR: MABEL DEAN HIGH SCH.ANNEX, 240 2ND AVE.                          DISTANCE CITY: 003              COMPASS SECTOR      : S
URBAN AREA (5601): NEW YORK, NY-NORTHEASTERN NJ                             MC IND: Y                       MET DATA            : Y
SUPPORTING AGENCY (001): NEW YORK STATE DEPARTM[illegible] OF ENVIRONMENTAL CONSERVA MSA (5600): NEW YORK, NY
COMMENTS: NYS#7093-05,START NO2,O3 11/18/76,TS[illegible] CO 10/3/77,SO2 2/5/78
SITE USER INFO: 1980 NECRMP,DISC.CO,O3 5/25,RESTART O3 9 24/82;ELEV.TSP 102'

PARAMETER      : 43102          ATTAIN STATUS   :               SAMPLING-BEGAN  : 86/06/02          DOMINANT-SOURCE  :
POC            : 1              ANALYZ LAB                      SAMPLING ENDED  :   /  /            MEAS-SCALE       :
MONITOR-TYPE   : 3              COLLECT-LAB     :               AUDIT-DATE      :   /  /            MONITORING-OBJ   :
MT-EFF-DATE    : 86/06/02       REPORT-ORG      :               DAYS-EXCLUDED   :                   SITING-CRITERIA  :
REF-METHOD     :                RO-EFFECT-DATE  :   /  /        PROJECT-CLASS   :                   SITING-CRIT-DATE :   /  /
REF-METH-DATE  :   /  /                                         ACT-TAKEN/REASON:     /             PROBE-HEIGHT     :
MONITOR-COMMENTS : SPECIAL STUDY OF N[illegible] METHANE ORGANIC COMPOUND

PARAMETER      : 43102          ATTAIN-STATUS   :               SAMPLING-BEGAN  : 86/06/05          DOMINANT-SOURCE  :
POC            : 2              ANALYZ-LAB      : 90[illegible]  SAMPLING-ENDED  :   /  /            MEAS-SCALE       :
MONITOR-TYPE   : 3              COLLECT-LAB     : 90[illegible]  AUDIT-DATE      :   /  /            MONITORING-OBJ   :
MT-EFF-DATE    : 86/06/05       REPORT-ORG      :               DAYS-EXCLUDED   :                   SITING-CRITERIA  :
REF-METHOD     :                RO-EFFECT-DATE  :   /  /        PROJECT-CLASS   :                   SITING CRIT-DATE :   /  /
REF-METH-DATE  :   /  /                                         ACT-TAKEN/REASON:     /             PROBE-HEIGHT     :
MONITOR-COMMENTS : NON METHANE ORGANIC COMPOUND S[illegible]    ANISTER AS POC1

PARAMETER      : 43102          [illegible] STATUS   :          SAMPLING-BEGAN  : 86/06/05          DOMINANT-SOURCE  :
POC            : 3              A[illegible]   LAB   : 908      SAMPLING-ENDED  :   /  /            MEAS-SCALE       :
MONITOR-TYPE   : 3              COLLECT-LAB     : 908           AUDIT-DATE      :   /  /            MONITORING-OBJ   :
MT-EFF-DATE    : 86/06/05       REPORT-ORG      :               DAYS-EXCLUDED   :                   SITING CRITERIA  :
REF-METHOD     :                RO-EFFECT-DATE  :   /  /        PROJECT-CLASS   :                   SITING CRIT-DATE :   /  /
REF-METH-DATE  :   /  /                                         ACT-TAKEN REASON:     /             PROBE-HEIGHT     :    /
MONITOR-COMMENTS : NON METHANE ORGANIC COMPOUND [illegible]    AT DIFFERENT CANISTER AS 1

SITE ID          : 36-061-0056 CITY (51000): NEW YORK CITY                  LATITUDE :  40:45:33 N  UTM EASTING         :   587250
CITY POPULATION :  7,071,639  COUNTY (061): NEW YORK CO                    LONGITUDE:  73:57:59 W  DIFF. GMT           : 05
AQCR POPULATION : 16,525,701  AQ[illegible]  (043): NEW JERS[illegible]EW YORK-CONNECTICU  UTM ZONE : 18   ELEVATION ABOVE MSL:    15 M
DATE ESTABLISHED: 85/0[illegible]/06  LAND USE (2): COMMERC.                UTM NORTHING: 4512310          RECORD LAST UPDATED: 89/10/26
DATE TERMINATED :   /  /      LOCATION SETTING (1): URBAN AND CENTER CITY  HQ EVAL DATE:   /  /          LAST R[illegible] EVAL  : 86/04/25
SITE ADDR: PS 59, 288 E. 57TH STREET, MANHATTAN                             DISTANCE CITY: 001              COMPASS SECTOR      : NE
URBAN AREA (5601): NEW YORK, NY-NORTHEASTERN NJ                             MC IND: Y                       MET DATA            : N
SUPPORTING AGENCY (001): NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVA MSA (5600): NEW YORK, NY
COMMENTS: NYS #7093-10, TSP, PM10 (DICHOT), SO2, NO2 MONITORING
SITE USER-INFO: SITE TEMPORARILY DISC. 870622, ROOF REPAIRS, NO2 TO UPPER ROOF
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DATE  11/02/89                         EPA AEROMETRIC INFORMATION RETRIEVAL SYSTEM (AIRS)
AMP380                                              AIR QUALITY SUBSYSTEM
                                                 SITE DESCRIPTION INVENTORY

EPA REGION: 06                                       STATE (48): TEXAS


SITE ID           : 48-113-0069 CITY (19000): DALLAS                       LATITUDE :  32:49:34 N  UTM EASTING         :   699960
CITY POPULATION :    904,078  COUNTY (113): DALLAS CO                      LONGITUDE:  96:51:50 W  DIFF. GMT           : 06
AQCR POPULATION :  3,257,903  AQCR   (215): METROPOLITAN DALLAS-FORT WORTH  UTM ZONE : 14          ELEVATION ABOVE MSL:  125 M
DATE ESTABLISHED:   /  /      LAND USE (2): COMMERCIAL                     UTM NORTHING: 3633840   RECORD LAST UPDATED: 89/10/26
DATE TERMINATED :   /  /      LOCATION SETTING (1): URBAN AND CENTER CITY  HQ EVAL DATE:   /  /    LAST REQ EVAL       : 86/12/11
SITE ADDR: 1415 HINTON ST.                                                 DISTANCE CITY:          COMPASS SECTOR      :
URBAN AREA (1920): DALLAS-FORT WORTH, TX                                   NC IND: Y               MET DATA            :
SUPPORTING AGENCY (000): ************** DESCRIPTION UNKNOWN ***************  MSA (1920): DALLAS, TX
COMMENTS: FORMERLY MOCKINGBIRD SITE 451310044H01
SITE-USER-INFO: OFFICES MOVED, NEW SITE NEEDED

PARAMETER      : 43102       ATTAIN-STATUS   :           SAMPLING-BEGAN  : 86/07/14        DOMINANT-SOURCE   :
POC            : 1           ANALYZ-LAB      : 908       SAMPLING-ENDED  :   /  /          MEAS-SCALE        :
MONITOR-TYPE   : 3           COLLECT-LAB     : 908       AUDIT-DATE      :   /  /          MONITORING-OBJ    :
MT EFF-DATE    : 86/07/14    REPORT-ORG      :           DAYS-EXCLUDED   :                 SITING-CRITERIA   :
REF-METHOD     :             NO-EFFECT-DATE  :   /  /    PROJECT-CLASS   :                 SITING-CRIT-DATE  :   /  /
REF METH-DATE  :   /  /                                  ACT-TAKEN/REASON:       /         PROBE-HEIGHT      :
MONITOR-COMMENTS : SPECIAL STUDY OF NON-METHANE ORGANIC COMPOUND

PARAMETER      : 43102       ATTAIN-STATUS   :           SAMPLING-BEGAN  : 86/07/30        DOMINANT-SOURCE   :
POC            : 2           ANALYZ-LAB      : 908       SAMPLING-ENDED  :   /  /          MEAS-SCALE        :
MONITOR-TYPE   : 3           COLLECT-LAB     : 908       AUDIT-DATE      :   /  /          MONITORING-OBJ    :
MT EFF-DATE    : 86/07/30    REPORT-ORG      :           DAYS-EXCLUDED   :                 SITING-CRITERIA   :
REF-METHOD     :             NO EFFECT-DATE  :   /  /    PROJECT-CLASS   :                 SITING CRIT-DATE  :   /  /
REF METH-DATE  :   /  /                                  ACT-TAKEN/REASON:       /         PROBE-HEIGHT      :
MONITOR-COMMENTS : NON METHANE ORGANIC COMPOUND SAME DAY/CANISTER AS POC1

PARAMETER      : 43102       ATTAIN-STATUS   :           SAMPLING-BEGAN  : 86/07/17        DOMINANT-SOURCE   :
POC            : 3           ANALYZ-LAB      : 908       SAMPLING-ENDED  :   /  /          MEAS-SCALE        :
MONITOR-TYPE   : 3           COLLECT-LAB     : 908       AUDIT-DATE      :   /  /          MONITORING-OBJ    :
MT EFF-DATE    : 86/07/17    REPORT-ORG      :           DAYS-EXCLUDED   :                 SITING-CRITERIA   :
REF METHOD     :             NO EFFECT-DATE  :   /  /    PROJECT-CLASS   :                 SITING CRIT-DATE  :   /  /
REF METH-DATE  :   /  /                                  ACT-TAKEN/REASON:       /         PROBE-HEIGHT      :
MONITOR-COMMENTS : NON METHANE ORGANIC COMPOUND SAME DAY DIFFERENT CANISTER AS 1


SITE ID           : 48-141-0037 CITY (24000): EL PASO                      LATITUDE :  31:46:06 N  UTM EASTING         :   357899
CITY POPULATION :    425,259  COUNTY (141): EL PASO CO                     LONGITUDE: 106:30:02 W  DIFF. GMT           : 07
AQCR POPULATION :    660,806  AQCR   (153): EL PASO LAS CRUCES-ALAMOGORDO  UTM ZONE : 13           ELEVATION ABOVE MSL:  1143 M
DATE ESTABLISHED:   /  /      LAND USE (2): COMMERCIAL                     UTM NORTHING: 3515551   RECORD LAST UPDATED: 89/10/26
DATE TERMINATED :   /  /      LOCATION SETTING ( ):                        HQ EVAL DATE:   /  /    LAST REQ EVAL       : 81/06/15
SITE ADDR: RIM RD. NEAR HAWTHORNE NEXT TO UT POLICE                        DISTANCE CITY:          COMPASS SECTOR      :
URBAN AREA (2320): EL PASO, TX                                             NC IND: Y               MET DATA            : Y
SUPPORTING AGENCY (001): TEXAS AIR CONTROL BOARD                           MSA (2320): EL PASO, TX
COMMENTS: CAMS 30
```

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DATE  11/02/89                    EPA AEROMETRIC INFORMATION RETRIEVAL SYSTEM (AIRS)
AMP380                                      AIR QUALITY SUBSYSTEM
                                          SITE DESCRIPTION INVENTORY

                                             STATE (48): TEXAS
EPA REGION: 06


SITE ID: 48-141-0037

                                                             SAMPLING-BEGAN   : 86/06/02        DOMINANT-SOURCE  :
PARAMETER      : 43102         ATTAIN-STATUS   :             SAMPLING-ENDED   :   /  /          MEAS-SCALE       :
POC            : 1             ANALYZ-LAB      : 908         AUDIT-DATE       :   /  /          MONITORING-OBJ   :
MONITOR-TYPE   : 3             COLLECT-LAB     : 908         DAYS-EXCLUDED    :                 SITING-CRITERIA  :
MT-EFF-DATE    : 86/06/02      REPORT-ORG      :             PROJECT-CLASS    :                 SITING-CRIT-DATE :   /  /
REF-METHOD     :               RO-EFFECT-DATE  :   /  /      ACT-TAKEN/REASON:      /           PROBE-HEIGHT     :
REF-METH-DATE  :   /  /
MONITOR-COMMENTS : SPECIAL STUDY OF NON-METHANE ORGANIC COMPOUND

                                                             SAMPLING-BEGAN   : 86/06/11        DOMINANT-SOURCE  :
PARAMETER      : 43102         ATTAIN-STATUS   :             SAMPLING-ENDED   :   /  /          MEAS-SCALE       :
POC            : 2             ANALYZ-LAB      : 908         AUDIT-DATE       :   /  /          MONITORING-OBJ   :
MONITOR-TYPE   : 3             COLLECT-LAB     : 908         DAYS-EXCLUDED    :                 SITING-CRITERIA  :
MT-EFF-DATE    : 86/06/11      REPORT-ORG      :             PROJECT-CLASS    :                 SITING-CRIT-DATE :   /  /
REF-METHOD     :               RO-EFFECT-DATE  :   /  /      ACT-TAKEN/REASON:      /           PROBE-HEIGHT     :
REF-METH-DATE  :   /  /
MONITOR-COMMENTS : NON-METHANE ORGANIC COMPOUND SAME DAY/CANISTER AS POC1

                                                             SAMPLING-BEGAN   : 86/06/09        DOMINANT-SOURCE  :
PARAMETER      : 43102         ATTAIN-STATUS   :             SAMPLING-ENDED   :   /  /          MEAS-SCALE       :
POC            : 3             ANALYZ-LAB      : 908         AUDIT-DATE       :   /  /          MONITORING-OBJ   :
MONITOR-TYPE   : 3             COLLECT-LAB     : 908         DAYS-EXCLUDED    :                 SITING-CRITERIA  :
MT-EFF-DATE    : 86/06/09      REPORT-ORG      :             PROJECT-CLASS    :                 SITING-CRIT-DATE :   /  /
REF-METHOD     :               RO-EFFECT-DATE  :   /  /      ACT-TAKEN/REASON:      /           PROBE-HEIGHT     :
REF-METH-DATE  :   /  /
MONITOR-COMMENTS : NON-METHANE ORGANIC COMPOUND SAME DAY DIFFERENT CANISTER AS 1

                                                                  LATITUDE :  29:46:17 N  UTM EASTING         :   285150
SITE ID         : 48-201-1034 CITY (35000): HOUSTON               LONGITUDE:  95:13:20 W  DIFF. GMT           : 06
CITY POPULATION :  1,595,138  COUNTY (201): HARRIS CO             UTM ZONE : 15           ELEVATION ABOVE ..  :    14 M
AQCR POPULATION :  3,276,239  AQCR   (216): METROPOLITAN HOUSTON-GALVESTON  UTM NORTHING: 3295344  RECORD LAST UPDATED: 89/10/26
DATE ESTABLISHED:   /  /      LAND USE (1): RESIDENTIAL           HQ EVAL DATE:   /  /    LAST REQ EVAL       : 83/03/03
DATE TERMINATED :   /  /      LOCATION SETTING (2): SUBURBAN      DISTANCE CITY:          COMPASS SECTOR      :
SITE ADDR: HARRIS ELEM SCH 1262 MAE DRIVE                         MC IND: Y               MET DATA            : Y
URBAN AREA (3  0): HOUSTON, TX                                    MSA (3360): HOUSTON, TX
SUPPORTING AGENCY (001): TEXAS AIR CONTROL BOARD
COMMENTS: EMSL TRACE METALS SAMPLING SITE

                                                             SAMPLING-BEGAN   : 73/01/01        DOMINANT-SOURCE  :
PARAMETER      : 43102         ATTAIN-STATUS   :             SAMPLING-ENDED   :   /  /          MEAS-SCALE       :
POC            : 1             ANALYZ-LAB      :             AUDIT-DATE       :   /  /          MONITORING-OBJ   :
MONITOR-TYPE   : 0             COLLECT-LAB     :             DAYS-EXCLUDED    :                 SITING-CRITERIA  :
MT-EFF-DATE    : 73/01/01      REPORT-ORG      :             PROJECT-CLASS    : 01              SITING-CRIT-DATE :   /  /
REF-METHOD     :               RO-EFFECT-DATE  :   /  /      ACT-TAKEN/REASON:      /           PROBE-HEIGHT     :   6 M
REF-METH-DATE  :   /  /
MONITOR COMMENTS : 11
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                                        EPA AEROMETRIC INFORMATION RETRIEVAL SYSTEM (AIRS)
DATE  11/02/89                                         AIR QUALITY SUBSYSTEM
AMP380                                               SITE DESCRIPTION INVENTORY

                                                        STATE (48): TEXAS
EPA-REGION: 06


SITE ID: 48-201-1034

                                                   SAMPLING-BEGAN   : 85/06/14        DOMINANT-SOURCE  :
PARAMETER      : 43102     ATTAIN-STATUS  :        SAMPLING-ENDED   :   /  /          MEAS-SCALE       :
POC            : 2         ANALYZ-LAB     : 908    AUDIT-DATE       :   /  /          MONITORING-OBJ   :
MONITOR-TYPE   : 3         COLLECT-LAB    : 908    DAYS-EXCLUDED    :                 SITING-CRITERIA  :
MT-EFF-DATE    : 85/06/14  REPORT-ORG     :        PROJECT-CLASS    :                 SITING-CRIT-DATE :   /  /
REF-METHOD     :           RO-EFFECT-DATE :   /  / ACT-TAKEN/REASON:      /           PROBE-HEIGHT     :
REF-METH-DATE  :   /  /
MONITOR-COMMENTS : SPECIAL STUDY OF NON-METHANE ORGANIC COMPOUND
                                                   SAMPLING-BEGAN   : 85/06/20        DOMINANT-SOURCE  :
PARAMETER      : 43102     ATTAIN-STATUS  :        SAMPLING-ENDED   :   /  /          MEAS-SCALE       :
POC            : 3         ANALYZ-LAB     : 908    AUDIT-DATE       :   /  /          MONITORING-OBJ   :
MONITOR-TYPE   : 3         COLLECT-LAB    : 908    DAYS-EXCLUDED    :                 SITING-CRITERIA  :
MT-EFF-DATE    : 85/06/20  REPORT-ORG     :        PROJECT-CLASS    :                 SITING-CRIT-DATE :   /  /
REF-METHOD     :           RO-EFFECT-DATE :   /  / ACT-TAKEN/REASON:      /           PROBE-HEIGHT     :
REF-METH-DATE  :   /  /
MONITOR-COMMENTS : NON-METHANE ORGANIC COMPOUND SAME DAY/CANISTER AS POC 2
                                                   SAMPLING-BEGAN   : 85/06/18        DOMINANT-SOURCE  :
PARAMETER      : 43102     ATTAIN-STATUS  :        SAMPLING-ENDED   :   /  /          MEAS-SCALE       :
POC            : 4         ANALYZ-LAB     : 908    AUDIT-DATE       :   /  /          MONITORING-OBJ   :
MONITOR-TYPE   : 3         COLLECT-LAB    : 908    DAYS-EXCLUDED    :                 SITING-CRITERIA  :
MT-EFF-DATE    : 85/06/18  REPORT-ORG     :        PROJECT-CLASS    :                 SITING-CRIT-DATE :   /  /
REF-METHOD     :           RO-EFFECT-DATE :   /  / ACT-TAKEN/REASON:      /           PROBE-HEIGHT     :
REF-METH-DATE  :   /  /
MONITOR-COMMENTS : NON-METHANE ORGANIC COMPOUND SAME DAY DIFFERENT CANISTER AS 2

                                                               LATITUDE :  30:02:22 N  UTM EASTING         :   396381
SITE ID          : 48-245-0009 CITY (07000): BEAUMONT          LONGITUDE:  94:04:29 W  DIFF. GMT           : 06
CITY POPULATION  :     118,102 COUNTY (245): JEFFERSON CO      UTM ZONE : 15           ELEVATION ABOVE MSL:    13 M
AQCR POPULATION  :   3,921,588 AQCR  (106): SOUTHERN LOUISIANA-SOUTHEAST T  UTM NORTHING: 3323462  RECORD LAST UPDATED: 89/10/26
DATE ESTABLISHED:   /  /       LAND USE (1): RESIDENTIAL       HQ EVAL DATE:   /  /    LAST REQ EVAL       :   /  /
DATE TERMINATED :   /  /       LOCATION SETTING (2): SUBURBAN  DISTANCE CITY:          COMPASS SECTOR    , :
SITE ADDR: GEORGIA AT CUNNINGHAM, BEAUMONT, TX                 MC IND:                 MET DATA            :
URBAN AREA (0839): BEAUMONT, TX                                MSA (0840): BEAUMONT-PORT ARTHUR, TX
SUPPORTING AGENCY (001): TEXAS AIR CONTROL BOARD
COMMENTS: MOVED FROM VIRGINIA ST
SITE-USER-INFO: LAMAR UNIVERSITY CAMPUS
                                                   SAMPLING-BEGAN   : 88/06/06        DOMINANT-SOURCE  :
PARAMETER      : 43102     ATTAIN-STATUS  :        SAMPLING-ENDED   :   /  /          MEAS-SCALE       :
POC            : 1         ANALYZ-LAB     : 908    AUDIT-DATE       :   /  /          MONITORING-OBJ   :
MONITOR-TYPE   : 3         COLLECT-LAB    : 908    DAYS-EXCLUDED    :                 SITING-CRITERIA  :
MT-EFF-DATE    : 88/06/06  REPORT-ORG     :        PROJECT-CLASS    :                 SITING-CRIT-DATE :   /  /
REF-METHOD     :           RO-EFFECT-DATE :   /  / ACT-TAKEN/REASON:      /           PROBE-HEIGHT     :
REF-METH-DATE  :   /  /
MONITOR-COMMENTS : SPECIAL STUDY OF NON-METHANE ORGANIC COMPOUND
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DATE  11/03/89                        EPA AEROMETRIC INFORMATION RETRIEVAL SYSTEM (AIRS)
AMP300                                            AIR QUALITY SUBSYSTEM
                                                 SITE DESCRIPTION INVENTORY

EPA REGION: 04                                     STATE (01): ALABAMA


                                                                           LATITUDE :   32:23:47 N  UTM EASTING          :    566275
SITE ID         : 01-101-0008 CITY (51000): MONTGOMERY                     LONGITUDE:   86:17:43 W  DIFF. GMT            : 06
CITY POPULATION :     177,857  COUNTY (101): MONTGOMERY CO                 UTM ZONE : 16            ELEVATION ABOVE MSL:    50 M
AQCR POPULATION :     792,096  AQCR   (002): COLUMBUS-PHENIX CITY          UTM NORTHING: 3584396    RECORD LAST UPDATED: 78/05/15
DATE ESTABLISHED:   /  /       LAND USE (3): INDUSTRIAL                    HQ EVAL DATE:   /  /     LAST REQ EVAL        :   /  /
DATE TERMINATED :   /  /       LOCATION SETTING (2): SUBURBAN              DISTANCE CITY:           COMPASS SECTOR       :
SITE ADDR: 1765 N. DECATUR ST.                                             HC IND:                  MET DATA             :
URBAN AREA (0000): NOT IN AN URBAN AREA
SUPPORTING AGENCY (000): ************** DESCRIPTION UNKNOWN ***************  MSA (5240): MONTGOMERY, AL
COMMENTS: LOCATED ON ROOF OF COMMUNITY CENTER
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DATE  11/03/89                            EPA AEROMETRIC INFORMATION RETRIEVAL SYSTEM (AIRS)
AMP380                                                   AIR QUALITY SUBSYSTEM
                                                       SITE DESCRIPTION INVENTORY

                                                          STATE (21): KENTUCKY
EPA REGION: 04


SITE ID          : 21-067-0012 CITY (46027): LEXINGTON-FAYETTE            LATITUDE :  38:03:47 N  UTM EASTING          :   719700
CITY POPULATION  :     204,165 COUNTY (067): FAYETTE CO                   LONGITUDE:  84:29:45 W  DIFF. GMT            : 05
AQCR POPULATION  :     547,199 AQCR   (102): BLUEGRASS                    UTM ZONE : 16           ELEVATION ABOVE MSL:    30 M
DATE ESTABLISHED:   /  /        LAND USE (3): INDUSTRIAL                  UTM NORTHING: 4215600   RECORD LAST UPDATED: 88/09/09
DATE TERMINATED :   /  /        LOCATION SETTING (2): SUBURBAN            HQ EVAL DATE:   /  /    LAST REQ EVAL        :   /  /
SITE ADDR: 650 NEWTOWN PIKE                                               DISTANCE CITY:          COMPASS SECTOR       :
URBAN AREA (0000): NOT IN AN URBAN AREA                                   HC IND:                 MET DATA             :
SUPPORTING AGENCY (000): *************** DESCRIPTION UNKNOWN ***************  MSA (4280): LEXINGTON-FAYETTE, KY
COMMENTS: KY. 2263
SITE-USER INFO: SLAMS SO2,OX,NO2
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DATE  11/03/89                        EPA AEROMETRIC INFORMATION RETRIEVAL SYSTEM (AIRS)
AMP380                                              AIR QUALITY SUBSYSTEM
                                                  SITE DESCRIPTION INVENTORY

EPA REGION: 07                                      STATE (29): MISSOURI


                                                                          LATITUDE :  38:37:28 N  UTM EASTING         :   743882
SITE ID          : 29-510-0072 CITY (65000): ST LOUIS                      LONGITUDE:  90:11:55 W  DIFF. GMT           : 06
CITY POPULATION :     453,085  COUNTY (510): ST LOUIS                      UTM ZONE : 15           ELEVATION ABOVE MSL:   154 M
AQCR POPULATION :   2,423,778  AQCR   (070): METROPOLITAN ST. LOUIS        UTM NORTHING: 4278618   RECORD LAST UPDATED: 89/08/10
DATE ESTABLISHED:   /  /       LAND USE (2): COMMERCIAL                    HQ EVAL DATE:   /  /    LAST REQ EVAL       :   /  /
DATE TERMINATED :   /  /       LOCATION SETTING (1): URBAN AND CENTER CITY DISTANCE CITY: 001      COMPASS SECTOR      : N
SITE ADDR: 1122 CLARK                                                      MC IND: Y               MET DATA            :
URBAN AREA (7040): ST. LOUIS, MO-IL                                        MSA (7040): ST. LOUIS, MO-IL
SUPPORTING AGENCY (003): ST LOUIS CITY DIVISION OF AIR POLLUTION CONTROL
COMMENTS: START-END OF 74
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DATE  11/03/89                                  EPA AEROMETRIC INFORMATION RETRIEVAL SYSTEM (AIRS)
AMP380                                                    AIR QUALITY SUBSYSTEM
                                                       SITE DESCRIPTION INVENTORY

EPA REGION: 04                                         STATE (37): NORTH CAROLINA


                                                                                      LATITUDE :  35:51:22 N  UTM EASTING          :    709950
SITE ID          : 37-183-0014 CITY (55000): RALEIGH                                  LONGITUDE:  78:40:30 W  DIFF. GMT            : 05
CITY POPULATION :     150,255  COUNTY (183): WAKE CO                                  UTM ZONE : 17           ELEVATION ABOVE MSL:
AQCR POPULATION :  1,082,284   AQCR   (166): EASTERN PIEDMONT                         UTM NORTHING: 3970285   RECORD LAST UPDATED: 89/08/31
DATE ESTABLISHED: 88/09/01     LAND USE (1): RESIDENTIAL                              HQ EVAL DATE:   /  /    LAST REQ EVAL        :   /  /
DATE TERMINATED :   /  /       LOCATION SETTING (2): SUBURBAN                         DISTANCE CITY:          COMPASS SECTOR       : SW
SITE ADDR: E MILLBROOK JR HI 3801 SPRING FOREST RD                                    HC IND: Y               MET DATA             : Y
URBAN AREA (6639): RALEIGH, NC
SUPPORTING AGENCY (001): NORTH CAROLINA DEPT NATURAL RESOURCES&COMMUNITY DE.
COMMENTS:
```

APPENDIX B

CRYOGENIC PRECONCENTRATION AND DIRECT FLAME IONIZATION DETECTION (PDFID) METHOD

COMPENDIUM METHOD T0-12

DETERMINATION OF NON-METHANE ORGANIC COMPOUNDS (NMOC) IN AMBIENT AIR USING CRYOGENIC PRE-CONCENTRATION AND DIRECT FLAME IONIZATION DETECTION (PDFID)

QUALITY ASSURANCE DIVISION
ENVIRONMENTAL MONITORING SYSTEMS LABORATORY
U.S. ENVIRONMENTAL PROTECTION AGENCY
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

MAY, 1988

METHOD TO12

METHOD FOR THE DETERMINATION OF NON-METHANE ORGANIC COMPOUNDS (NMOC) IN AMBIENT AIR USING CRYOGENIC PRECONCENTRATION AND DIRECT FLAME IONIZATION DETECTION (PDFID)

1. Scope

1.1 In recent years, the relationship between ambient concentrations of precursor organic compounds and subsequent downwind concentrations of ozone has been described by a variety of photochemical dispersion models. The most important application of such models is to determine the degree of control of precursor organic compounds that is necessary in an urban area to achieve compliance with applicable ambient air quality standards for ozone (1,2).

1.2 The more elaborate theoretical models generally require detailed organic species data obtained by multicomponent gas chromatography (3 The Empirical Kinetic Modeling Approach (EKMA), however, requires only the total non-methane organic compound (NMOC) concentration data; specifically, the average total NMOC concentration from 6 a.m. to 9 a.m. daily at the sampling location. The use of total NMOC concentration data in the EKMA substantially reduces the cost and complexity of the sampling and analysis system by not requiring qualitative and quantitative species identification.

1.3 Method TO1, "Method for The Determination of Volatile Organic Compounds in Ambient Air Using Tenax® Adsorption and Gas Chromatography/Mass Spectrometry (GC/MS)", employs collection of certain volatile organic compounds on Tenax® GC with subsequent analysis by thermal desorption/cryogenic preconcentration and GC/MS identification. This method (TO12) combines the same type of cryogenic concentration technique used in Method TO1 for high sensitivity with the simple flame ionization detector (FID) of the GC for total NMOC measurements, without the GC columns and complex procedures necessary for species separation.

1.4 In a flame ionization detector, the sample is injected into a hydrogen-rich flame where the organic vapors burn producing ionized molecular fragments. The resulting ion fragments are then collected and detected. The FID is nearly a universal detector. However, the detector response varies with the species of [functional group in] the organic compound in an oxygen atmosphere. Because this method employs a helium or argon carrier gas, the detector response is nearly one for all compounds. Thus, the historical short-coming of the FID involving varying detector response to different organic functional groups is minimized.

1.5 The method can be used either for direct, in situ ambient measurements or (more commonly) for analysis of integrated samples collected in specially treated stainless steel canisters. EKMA models generally require 3-hour integrated NMOC measurements over the 6 a.m. to 9 a.m. period and are used by State or local agencies to prepare State Implementation Plans (SIPs) for ozone control to achieve compliance with the National Ambient Air Quality Standards (NAAQS) for ozone. For direct, in situ ambient measurements, the analyst must be present during the 6 a.m. to 9 a.m. period, and repeat measurements (approximately six per hour) must be taken to obtain the 6 a.m. to 9 a.m. average NMOC concentration. The use of sample canisters allows the collection of integrated air samples over the 6 a.m. to 9 a.m. period by unattended, automated samplers. This method has incorporated both sampling approaches.

2. Applicable Documents

2.1 ASTM Standards

D1356 - Definition of Terms Related to Atmospheric Sampling and Analysis

E260 - Recommended Practice for General Gas Chromatography Procedures

E355 - Practice for Gas Chromatography Terms and Relationships

2.2 Other Documents

U. S. Environmental Protection Agency Technical Assistance Documents (4,5)
Laboratory and Ambient Air Studies (6-10)

3. Summary of Method

3.1 A whole air sample is either extracted directly from the ambient air and analyzed on site by the GC system or collected into a precleaned sample canister and analyzed off site.

3.2 The analysis requires drawing a fixed-volume portion of the sample air at a low flow rate through a glass-bead filled trap that is cooled to approximately -186°C with liquid argon. The cryogenic trap simultaneously collects and concentrates the NMOC (either via condensation or adsorption) while allowing the methane, nitrogen, oxygen, etc. to pass through the trap without retention. The system is dynamically calibrated so that the volume of sample passing through the trap does not have to be quantitatively measured, but must be precisely repeatable between the calibration and the analytical phases.

3.3 After the fixed-volume air sample has been drawn through the trap, a helium carrier gas flow is diverted to pass through the trap, in the opposite direction to the sample flow, and into an FID. When the residual air and methane have been flushed from the trap and the FID baseline restabilizes, the cryogen is removed and the temperature of the trap is raised to approximately 90°C.

3.4 The organic compounds previously collected in the trap revolatilize due to the increase in temperature and are carried into the FID, resulting in a response peak or peaks from the FID. The area of the peak or peaks is integrated, and the integrated value is translated to concentration units via a previously-obtained calibration curve relating integrated peak areas with known concentrations of propane.

3.5 By convention, concentrations of NMOC are reported in units of parts per million carbon (ppmC), which, for a specific compound, is the concentration by volume (ppmV) multiplied by the number of carbon atoms in the compound.

3.6 The cryogenic trap simultaneously concentrates the NMOC while separating and removing the methane from air samples. The technique is thus direct reading for NMOC and, because of the concentration step, is more sensitive than conventional continuous NMOC analyzers.

4. Significance

4.1 Accurate measurements of ambient concentrations of NMOC are important for the control of photochemical smog because these organic compounds are primary precursors of atmospheric ozone and other oxidants. Achieving and maintaining compliance with the NAAQS for ozone thus depends largely on control of ambient levels of NMOC.

4.2 The NMOC concentrations typically found at urban sites may range up to 5-7 ppmC or higher. In order to determine transport of precursors into an area, measurement of NMOC upwind of the area may be necessary. Upwind NMOC concentrations are likely to be less than a few tenths of 1 ppm.

4.3 Conventional methods that depend on gas chromatography and qualitative and quantitative species evaluation are excessively difficult and expensive to operate and maintain when speciated measurements are not needed. The method described here involves a simple, cryogenic preconcentration procedure with subsequent, direct, flame ionization detection. The method is sensitive and provides accurate measurements of ambient NMOC concentrations where speciated data are not required as applicable to the EKMA.

5. Definitions

[Note: Definitions used in this document and in any user-prepared Standard Operating Procedures (SOPs) should be consistent with ASTM Methods D1356 and E355. All abbreviations and symbols are defined within this document at point of use.]

5.1 Absolute pressure - Pressure measured with reference to absolute zero pressure (as opposed to atmospheric pressure), usually expressed as pounds-force per square inch absolute (psia).

5.2 Cryogen - A substance used to obtain very low trap temperatures in the NMOC analysis system. Typical cryogens are liquid argon (bp -185.7) and liquid oxygen (bp-183.0).

5.3 Dynamic calibration - Calibration of an analytical system with pollutant concentrations that are generated in a dynamic, flowing system, such as by quantitative, flow-rate dilution of a high concentration gas standard with zero gas.

5.4 EKMA - Empirical Kinetics Modeling Approach; an empirical model that attempts to relate morning ambient concentrations of nonmethane organic compounds (NMOC) and NO_x with subsequent peak, downwind ambient ozone concentrations; used by pollution control agencies to estimate the degree of hydrocarbon emission reduction needed to achieve compliance with national ambient air quality standards for ozone.

5.5 Gauge pressure - Pressure measured with reference to atmospheric pressure (as opposed to absolute pressure). Zero gauge pressure (0 psig) is equal to atmospheric pressure, or 14.7 psia (101 kPa).

5.6 *In situ* - In place; *In situ* measurements are obtained by direct, on-the-spot analysis, as opposed to subsequent, remote analysis of a collected sample.

5.7 Integrated sample - A sample obtained uniformly over a specified time period and representative of the average levels of pollutants during the time period.

5.8 NMOC - Nonmethane organic compounds; total organic compounds as measured by a flame ionization detector, excluding methane.

5.9 ppmC - Concentration unit of parts per million carbon; for a specific compound, ppmC is equivalent to parts per million by volume (ppmv) multiplied by the number of carbon atoms in the compound.

5.10 Sampling - The process of withdrawing or isolating a representative portion of an ambient atmosphere, with or without the simultaneous isolation of selected components for subsequent analysis.

6. Interferences

6.1 In field and laboratory evaluation, water was found to cause a positive shift in the FID baseline. The effect of this shift is minimized by carefully selecting the integration termination point and adjusted baseline used for calculating the area of the NMOC peak(s).

6.2 When using helium as a carrier gas, FID response is quite uniform for most hydrocarbon compounds, but the response can vary considerably for other types of organic compounds.

7. Apparatus

7.1 Direct Air Sampling (Figure 1)

7.1.1 Sample manifold or sample inlet line - to bring sample air into the analytical system.

7.1.2 Vacuum pump or blower - to draw sample air through a sample manifold or long inlet line to reduce inlet residence time. Maximum residence time should be no greater than 1 minute.

7.2 Remote Sample Collection in Pressurized Canisters (Figure 2)

7.2.1 Sample canister(s) - stainless steel, Summa®-polished vessel(s) of 4-6 L capacity (Scientific Instrumentation Specialists, Inc., P.O. Box 8941, Moscow, ID 83843), used for automatic collection of 3-hour integrated field air samples. Each canister should have a unique identification number stamped on its frame.

7.2.2 Sample pump - stainless steel, metal bellows type (Model MB-151, Met[illegible] Bellows Corp., 1075 Providence Highway, [illegible]haron, [illegible]2067) capable of 2 atmospheres minimum output pressure. Pump must be free of leaks, clean, and uncontaminated by oil or organic compounds.

7.2.3 Pressure gauge - 0-30 psig (0-240 kPa).

7.2.4 Solenoid valve - special electrically-operated, bistable solenoid valve (Skinner Magnelatch Valve, New Britain, CT), to control sample flow to the canister with negligible temperature rise (Figure 3). The use of the Skinner Magnelatch valve avoids any substantial temperature rise that would occur with a conventional, normally closed solenoid valve, which would have to be energized during the entire sample period. This temperature rise in the valve could cause outgasing of organics from the Viton valve seat material. The Skinner Magnelatch valve requires only a brief electrical pulse to open or close at the appropriate start and stop times and therefore experiences no temperature increase. The pulses may be obtained with an electronic timer that can be programmed for short (5 to 60 seconds) ON periods or with a conventional mechanical timer and a special pulse circuit. Figure 3 [a] illustrates a simple electrical pulse circuit for operating the Skinner Magnelatch solenoid valve with a conventional mechanical timer. However, with this simple circuit, the valve may operate unpredictably during brief power interruptions or if the timer is manually switched on and off too fast. A better circuit incorporating a time-delay relay to provide more reliable valve operation is shown in Figure 3[b].

7.2.5 Stainless steel orifice (or short capillary) - capable of maintaining a substantially constant flow over the sampling period (see Figure 4).

7.2.6 Particulate matter filter - 2 micron stainless steel sintered in-line type (see Figure 4).

7.2.7 Timer - used for unattended sample collection. Capable of controlling pump(s) and solenoid valve.

7.3 Sample Canister Cleaning (Figure 5)

7.3.1 Vacuum pump - capable of evacuating sample canister(s) to an absolute pressure of <5 mm Hg.

7.3.2 Manifold - stainless steel manifold with connections for simultaneously cleaning several canisters.

7.3.3 Shut off valve(s) - seven required.

7.3.4 Vacuum gauge - capable of measuring vacuum in the manifold to an absolute pressure of 5 mm Hg or less.

7.3.5 Cryogenic trap (2 required) - U-shaped open tubular trap cooled with liquid nitrogen or argon used to prevent contamination from back diffusion of oil from vacuum pump, and to provide clean, zero air to sample canister(s).

7.3.6 Pressure gauge - 0-50 psig (0-345 kPa), to monitor zero air pressure.

7.3.7 Flow control valve - to regulate flow of zero air into canister(s).

7.3.8 Humidifier - water bubbler or other system capable of providing moisture to the zero air supply.

7.4 Analytical System (Figure 1)

7.4.1 FID detector system - including flow controls for the FID fuel and air, temperature control for the FID, and signal processing electronics. The FID burner air, hydrogen, and helium carrier flow rates should be set according to the manufacturer's instructions to obtain an adequate FID response while maintaining as stable a flame as possible throughout all phases of the analytical cycle.

7.4.2 Chart recorder - compatible with the FID output signal, to record FID response.

7.4.3 Electronic integrator - capable of integrating the area of one or more FID response peaks and calculating peak area corrected for baseline drift. If a separate integrator and chart recorder are used, care must be exercised to be sure that these components do not interfere with each other electrically. Range selector controls on both the integrator and the FID analyzer may not provide accurate range ratios, so individual calibration curves should be prepared for each range to be used. The integrator should be capable of marking the beginning and ending of peaks, constructing the appropriate baseline between the start and end of the integration period, and calculating the peak area.

Note: The FID (7.4.1), chart recorder (7.4.2), integrator (7.4.3), valve heater (7.4.5), and a trap heating system are conveniently provided by a standard laboratory chromatograph and associated integrator. EPA has adapted two such systems for the PDFID method: a Hewlett-Packard model 5880 (Hewlett-Packard Corp., Avondale, PA) and a Shimadzu model GC8APF (Shimadzu Scientific Instruments Inc., Columbia, MD; see Reference 5). Other similar systems may also be applicable.

7.4.4 Trap - the trap should be carefully constructed from a single piece of chromatographic-grade stainless steel tubing (0.32 cm O.D, 0.21 cm I.D.) as shown in Figure 6. The central portion of the trap (7-10 cm) is packed with 60/80 mesh glass beads, with small glass wool (dimethyldichlorosilane-treated) plugs to retain the beads. The trap must fit conveniently into the Dewar flask (7.4.9), and the arms must be of an appropriate length to allow the beaded portion of the trap to be submerged below the level of liquid cryogen in the Dewar. The trap should connect directly to the six-port valve, if possible, to minimize line length between the trap and the FID. The trap must be mounted to allow the Dewar to be slipped conveniently on and off the trap and also to facilitate heating of the trap (see 7.4.13).

7.4.5 Six-port chromatographic valve - Seiscor Model VIII (Seismograph Service Corp., Tulsa, OK), Valco Model 9110 (Valco Instruments Co., Houston, TX), or equivalent. The six-port valve and as much of the interconnecting tubing as practical should be located inside an oven or otherwise heated to 80 - 90°C to minimize wall losses or adsorption/desorption in the connecting tubing. All lines should be as short as practical.

7.4.6 Multistage pressure regulators - standard two-stage, stainless steel diaphram regulators with pressure gauges, for helium, air, and hydrogen cylinders.

7.4.7 Pressure regulators - optional single stage, stainless steel, with pressure gauge, if needed, to maintain constant helium carrier and hydrogen flow rates.

7.4.8 Fine needle valve - to adjust sample flow rate through trap.

7.4.9 Dewar flask - to hold liquid cryogen to cool the trap, sized to contain submerged portion of trap.

7.4.10 Absolute pressure gauge - 0-450 mm Hg,(2 mm Hg [scale divisions indicating units]), to monitor repeatable volumes of sample air through cryogenic trap (Wallace and Tiernan, Model 61C-ID-0410, 25 Main Street, Belleville, NJ).

7.4.11 Vacuum reservoir - 1-2 L capacity, typically 1 L.

7.4.12 Gas purifiers - gas scrubbers containing Drierite® or silica gel and 5A molecular sieve to remove moisture and organic impurities in the helium, air, and hydrogen gas flows (Alltech Associates, Deerfield, IL). Note: Check purity of gas purifiers prior to use by passing zero-air through the unit and analyzing according to Section 11.4. Gas purifiers are clean if produce [contain] less than 0.02 ppmC hydrocarbons.

7.4.13 Trap heating system - chromatographic oven, hot water, or other means to heat the trap to 80° to 90°C. A simple heating source for the trap is a beaker or Dewar filled with water maintained at 80-90°C. More repeatable types of heat sources are recommended, including a temperature-programmed chromatograph oven, electrical heating of the trap itself, or any type of heater that brings the temperature of the trap up to 80-90°C in 1-2 minutes.

7.4.14 Toggle shut-off valves (2) - leak free, for vacuum valve and sample valve.

7.4.15 Vacuum pump - general purpose laboratory pump capable of evacuating the vacuum reservoir to an appropriate vacuum that allows the desired sample volume to be drawn through the trap.

7.4.16 Vent - to keep the trap at atmospheric pressure during trapping when using pressurized canisters.

7.4.17 Rotameter - to verify vent flow.

7.4.18 Fine needle valve (optional) - to adjust flow rate of sample from canister during analysis.

7.4.19 Chromatographic-grade stainless steel tubing (Alltech Applied Science, 2051 Waukegan Road, Deerfield, IL, 60015, (312) 948-8600) and stainless steel plumbing fittings - for interconnections. All such materials in contact with the sample, analyte, or support gases prior to analysis should be stainless steel or other inert metal. Do not use plastic or Teflon® tubing or fittings.

7.5 Commercially Available PDFID System (5)

7.5.1 A convenient and cost-effective modular PDFID system suitable for use with a conventional laboratory chromatograph is commercially available (NuTech Corporation, Model 8548, 2806 Cheek Road, Durham, NC, 27704, (919) 682-0402).

7.5.2 This modular system contains almost all of the apparatus items needed to convert the chromatograph into a PDFID analytical system and has been designed to be readily available and easy to assemble.

8. Reagents and Materials

8.1 Gas cylinders of helium and hydrogen - ultrahigh purity grade.

8.2 Combustion air - cylinder containing less than 0.02 ppm hydrocarbons, or equivalent air source.

8.3 Propane calibration standard - cylinder containing 1-100 ppm (3-300 ppmC) propane in air. The cylinder assay should be traceable to a National Bureau of Standards (NBS) Standard Reference Material (SRM) or to a NBS/EPA-approved Certified Reference Material (CRM).

8.4 Zero air - cylinder containing less than 0.02 ppmC hydrocarbons. Zero air may be obtained from a cylinder of zero-grade compressed air scrubbed with Drierite® or silica gel and 5A molecular sieve or activated charcoal, or by catalytic cleanup of ambient air. All zero air should be passed through a liquid argon cold trap for final cleanup, then passed through a hyrdocarbon-free water bubbler (or other device) for humidification.

8.5 Liquid cryogen - liquid argon (bp -185.7°C) or liquid oxygen, (bp -183°C) may be used as the cryogen. Experiments have shown no differences in trapping efficiency between liquid argon and liquid oxygen. However, appropriate safety precautions must be taken if liquid oxygen is used. Liquid nitrogen (bp -195°C) should not be used because it causes condensation of oxygen and methane in the trap.

9. Direct Sampling

9.1 For direct ambient air sampling, the cryogenic trapping system draws the air sample directly from a pump-ventilated distribution manifold or sample line (see Figure 1). The connecting line should be of small diameter (1/8" O.D.) stainless steel tubing and as short as possible to minimize its dead volume.

9.2 Multiple analyses over the sampling period must be made to establish hourly or 3-hour NMOC concentration averages.

10. Sample Collection in Pressurized Canister(s)

For integrated pressurized canister sampling, ambient air is sampled by a metal bellows pump through a critical orifice (to maintain constant flow), and pressurized into a clean, evacuated, Summa®-polished sample canister. The critical orifice size is chosen so that the canister is pressurized to approximately one atmosphere above ambient pressure, at a constant flow rate over the desired sample period. Two canisters are connected in parallel for duplicate samples. The canister(s) are then returned to the laboratory for analysis, using the PDFID analytical system. Collection of ambient air samples in pressurized canisters provides the following advantages:

- Convenient integration of ambient samples over a specific time period
- Capability of remote sampling with subsequent central laboratory analysis
- Ability to ship and store samples, if necessary

- o Unattended sample collection
- o Analysis of samples from multiple sites with one analytical system
- o Collection of replicate samples for assessment of measurement precision

With canister sampling, however, great care must be exercised in selecting, cleaning, and handling the sample canister(s) and sampling apparatus to avoid losses or contamination of the samples.

10.1 Canister Cleanup and Preparation

10.1.1 All canisters must be clean and free of any contaminants before sample collection.

10.1.2 Leak test all canisters by pressurizing them to approximately 30 psig [200 kPa (gauge)] with zero air. The use of the canister cleaning system (see Figure 5) may be adequate for this task. Measure the final pressure - close the canister valve, then check the pressure after 24 hours. If leak tight, the pressure should not vary more than ± 2 psig over the 24-hour period. Note leak check result on sampling data sheet, Figure 7.

10.1.3 Assemble a canister cleaning system, as illustrated in Figure 5. Add cryogen to both the vacuum pump and zero air supply traps. Connect the canister(s) to the manifold. Open the vent shut off valve and the canister valve(s) to release any remaining pressure in the canister. Now close the vent shut off valve and open the vacuum shut off valve. Start the vacuum pump and evacuate the canister(s) to ≤ 5.0 mm Hg (for at least one hour). [Note: On a daily basis or more often if necessary, blowout the cryogenic traps with zero air to remove any trapped water from previous canister cleaning cycles.]

10.1.4 Close the vacuum and vacuum gauge shut off valves and open the zero air shut off valve to pressurize the canister(s) with moist zero air to approximately 30 psig [200 kPa (gauge)]. If a zero gas generator system is used, the flow rate may need to be limited to maintain the zero air quality.

10.1.5 Close the zero shut off valve and allow canister(s) to vent down to atmospheric pressure through the vent shut off valve. Close the vent shut off valve. Repeat steps 10.1.3 through 10.1.5 two additional times for a total of three (3) evacuation/pressurization cycles for each set of canisters.

10.1.6 As a "blank" check of the canister(s) and cleanup procedure, analyze the final zero-air fill of 100% of the canisters until the cleanup system and canisters are proven reliable. This check can then be reduced to a lower percentage of canisters. Any canister that does not test clean (compared to direct analysis of humidified zero air of less than 0.02 ppmC) should not be utilized.

10.1.7 The canister is then re-evacuated to $\leq$ 5.0 mm Hg, using the canister cleaning system, and remains in this condition until use. Close the canister valve, remove the canister from the canister cleaning system and cap canister connection with a stainless steel fitting. The canister is now ready for collection of an air sample. Attach an identification tag to the neck of each canister for field notes and chain-of-custody purposes.

10.2 Collection of Integrated Whole-Air Samples

10.2.1 Assemble the sampling apparatus as shown in Figure 2. The connecting lines between the sample pump and the canister(s) should be as short as possible to minimize their volume. A second canister is used when a duplicate sample is desired for quality assurance (QA) purposes (see Section 12.2.4). The small auxiliary vacuum pump purges the inlet manifold or lines with a flow of several L/min to minimize the sample residence time. The larger metal bellows pump takes a small portion of this sample to fill and pressurize the sample canister(s) Both pumps should be shock-mounted to minimize vibration. Prior to field use, each sampling system should be leak tested. The outlet side of the metal bellows pump can be checked for leaks by attaching the 0-30 psig pressure gauge to the canister(s) inlet via connecting tubing and pressurizing to 2 atmospheres or approximately 29.4 psig. If pump and connecting lines are leak free pressure should remain at ±2 psig for 15 minutes. To check the inlet side, plug the sample inlet and insure that there is no flow at the outlet of the pump.

10.2.2 Calculate the flow rate needed so that the canister(s) are pressurized to approximately one atmosphere above ambient pressure (2 atmospheres absolute pressure) over the desired sample period, utilizing the following equation:

$$F = \frac{(P)(V)(N)}{(T)(60)}$$

where:

F = flow rate (cm^3/min)
P = final canister pressure (atmospheres absolute)
= $(P_g/P_a) + 1$
V = volume of the canister (cm^3)
N = number of canisters connected together for simultaneous sample collection
T = sample period (hours)
P_g = gauge pressure in canister, psig (kPa)
Pa = standard atmospheric pressure, 14.7 psig (101 kPa)

For example, if one 6-L canister is to be filled to 2 atmospheres absolute pressure (14.7 psig) in 3 hours, the flow rate would be calculated as follows:

$$F = \frac{2 \times 6000 \times 1}{3 \times 60} = 67 \text{ cm}^3\text{/min}$$

10.2.3 Select a critical orifice or hypodermic needle suitable to maintain a substantially constant flow at the calculated flow rate into the canister(s) over the desired sample period. A 30-gauge hypodermic needle, 2.5 cm long, provides a flow of approximately 65 cm^3/min with the Metal Bellows Model MBV-151 pump (see Figure 4). Such a needle will maintain approximately constant flow up to a canister pressure of about 10 psig (71 kPa), after which the flow drops with increasing pressure. At 14.7 psig (2 atmospheres absolute pressure), the flow is about 10% below the original flow.

10.2.4 Assemble the 2.0 micron stainless steel in-line particulate filter and position it in front of the critical orifice. A suggested filter-hypodermic needle assembly can be fabricated as illustrated in Figure 4.

10.2.5 Check the sampling system for contamination by filling two evacuated, cleaned canister(s) (See Section 10.1) with humidified zero air through the sampling system. Analyze the canisters according to Section [illegible].4. The sampling system is free of contamination if the canisters contain less than 0.02 ppmC hydrocarbons, similar to that of humidified zero air.

10.2.6 During the system contamination check procedure, check the critical orifice flow rate on the sampling system to insure that sample flow rate remains relatively constant (±10%) up to about 2 atmospheres absolute pressure (101 kPa). Note: A drop in the flow rate may occur near the end of the sampling period as the canister pressure approaches two atmospheres.

10.2.7 Reassemble the sampling system. If the inlet sample line is longer than 3 meters, install an auxiliary pump to ventilate the sample line, as illustrated in Figure 2.

10.2.8 Verify that the timer, pump(s) and solenoid valve are connected and operating properly.

10.2.9 Verify that the timer is correctly set for the desired sample period, and that the solenoid valve is closed.

10.2.10 Connect a cleaned, evacuated canister(s) (Section 10.1) to the non-contaminated sampling system, by way of the solenoid valve, for sample collection.

10.2.11 Make sure the solenoid valve is closed. Open the canister valve(s). Temporarily connect a small rotameter to the sample inlet to verify that there is no flow. Note: Flow detection would indicate a leaking (or open) solenoid valve. Remove the rotameter after leak detection procedure.

10.2.12 Fill out the necessary information on the Field Data Sheet (Figure 7).

10.2.13 Set the automatic timer to start and stop the pump or pumps to open and close the solenoid valve at the appropriate time for the intended sample period. Sampling will begin at the pre-determined time.

10.2.14 After the sample period, close the canister valve(s) and disconnect the canister(s) from the sampling system. Connect a pressure gauge to the canister(s) and briefly open and close the canister valve. Note the canister pressure on the Field Data Sheet (see Figure 7). The canister pressure should be approximately 2 atmospheres absolute [1 atmosphere or 101 kPa (gauge)]. Note: If the canister pressure is not approximately 2 atmospheres absolute (14.7 psig), determine and correct the cause before next sample. Re-cap canister valve.

10.2.15 Fill out the identification tag on the sample canister(s) and complete the Field Data Sheet as necessary. Note any activities or special conditions in the area (rain, smoke, etc.) that may affect the sample contents on the sampling data sheet.

10.2.16 Return the canister(s) to the analytical system for analysis.

11. Sample Analysis

11.1 Analytical System Leak Check

11.1.1 Before sample analysis, the analytical system is assembled (see Figure 1) and leak checked.

11.1.2 To leak check the analytical system, place the six-port gas valve in the trapping position. Disconnect and cap the absolute pressure gauge. Insert a pressure gauge capable of recording up to 60 psig at the vacuum valve outlet.

11.1.3 Attach a valve and a zero air supply to the sample inlet port. Pressurize the system to about 50 psig (350 kPa) and close the valve.

11.1.4 Wait approximately 3 hrs. and re-check pressure. If the pressure did not vary more than ± 2 psig, the system is considered leak tight.

11.1.5 If the system is leak free, de-pressurize and reconnect absolute pressure gauge.

11.1.6 The analytical system leak check procedure needs to be performed during the system checkout, during a series of analysis or if leaks are suspected. This should be part of the user-prepared SOP manual (see Section 12.1).

11.2 Sample Volume Determination

11.2.1 The vacuum reservoir and absolute pressure gauge are used to meter a precisely repeatable volume of sample air through the cryogenically-cooled trap, as follows: With the sample valve closed and the vacuum valve open, the reservoir is first evacuated with the vacuum pump to a predetermined pressure (e.g., 100 mm Hg). Then the vacuum valve is closed and the sample valve is opened to allow sample air to be drawn through the cryogenic trap and into the evacuated reservoir until a second predetermined reservoir pressure is reached (e.g., 300 mm Hg). The (fixed) volume of air thus sampled is determined by the pressure rise in the vacuum reservoir (difference between the predetermined pressures) as measured by the absolute pressure gauge (see Section 12.2.1).

11.2.2 The sample volume can be calculated by:

$$V_s = \frac{(\Delta P)(V_r)}{(P_s)}$$

where:

V_s = volume of air sampled (standard cm^3)

ΔP = pressure difference measured by gauge (mm Hg)

V_r = volume of vacuum reservoir (cm^3) usually 1 L

P_s = standard pressure (760 mm Hg)

For example, with a vacuum reservoir of 1000 cm^3 and a pressure change of 200 mm Hg (100 to 300 mm Hg), the volume sampled would be 263 cm^3. [Note: Typical sample volume using this procedure is between 200-300 cm^3.]

11.2.3 The sample volume determination need only be performed once during the system check-out and shall be part of the user-prepared SOP Manual (see Section 12.1).

11.3 Analytical System Dynamic Calibration

11.3.1 Before sample analysis, a complete dynamic calibration of the analytical system should be carried out at five or more concentrations on each range to define the calibration curve. This should be carried out initially and periodically thereafter [may be done only once during a series of analyses]. This should be part of the user-prepared SOP Manual (See Section 12.1). The calibration should be verified with two or three-point calibration checks (including zero) each day the analytical system is used to analyze samples.

11.3.2 Concentration standards of propane are used to calibrate the analytical system. Propane calibration standards may be obtained directly from low concentration cylinder standards or by dilution of high concentration cylinder standards with zero air (see Section 8.3). Dilution flow rates must be measured accurately, and the combined gas stream must be mixed thoroughly for successful calibration of the analyzer. Calibration standards should be sampled directly from a vented manifold or tee. Note: Remember that a propane NMOC concentration in ppmC is three times the volumetric concentration in ppm.

11.3.3 Select one or more combinations of the following parameters to provide the desired range or ranges (e.g., 0-1.0 ppmC or 0-5.0 ppmC): FID attenuator setting, output voltage setting, integrator resolution (if applicable), and sample volume. Each individual range should be calibrated separately and should have a separate calibration curve. Note: Modern GC integrators may provide automatic ranging such that several decades of concentration may be covered in a single range. The user-prepared SOP manual should address variations applicable to a specific system design (see Section 12.1).

11.3.4 Analyze each calibration standard three times according to the procedure in Section 11.4. Insure that flow rates, pressure gauge start and stop readings, initial cryogen liquid level in the dewar, timing, heating, integrator settings, and other variables are the same as those that will be used during analysis of ambient samples. Typical flow rates for the gases are: hydrogen, 30 cm^3/minute; helium carrier, 30 cm^3/minute; burner air, 400 cm^3/minute.

11.3.5 Average the three analyses for each concentration standard and plot the calibration curve(s) as average integrated peak area reading versus concentration in ppmC. The relative standard deviation for the three analyses should be less than 3% (except for zero concentration). Linearity should be expected; points that appear to deviate abnormally should be repeated. Response has been shown to be linear over a wide range (0-10,000 ppbC). If nonlinearity is observed, an effort should be made to identify and correct the problem. If the problem cannot be corrected, additional points in the nonlinear region may be needed to define the calibration curve adequately.

11.4 Analysis Procedure

11.4.1 Insure the analytical system has been assembled properly, leaked checked, and properly calibrated through a dynamic standard calibration. Light the FID detector and allow to stabilize.

11.4.2 Check and adjust the helium carrier pressure to provide the correct carrier flow rate for the system. Helium is used to purge residual air and methane from the trap at the end of the sampling phase and to carry the re-volatilized NMOC from the trap into the FID. A single-stage auxiliary regulator between the cylinder and the analyzer may not be necessary, but is recommended to regulate the helium pressure better than the multistage cylinder regulator. When an auxiliary regulator is used, the secondary stage of the two-stage regulator must be set at a pressure higher than the pressure setting of the single-stage regulator. Also check the FID hydrogen and burner air flow rates (see 11.3.4).

11.4.3 Close the sample valve and open the vacuum valve to evacuate the vacuum reservoir to a specific predetermined value (e.g., 100 mm Hg).

11.4.4 With the trap at room temperature, place the six-port valve in the inject position.

11.4.5 Open the sample valve and adjust the sample flow rate needle valve for an appropriate trap flow of 50-100 cm^3/min. Note: The flow will be lower later, when the trap is cold.

11.4.6 Check the sample canister pressure before attaching it to the analytical system and record on Field Data Sheet (see Figure 7). Connect the sample canister or direct sample inlet to the six-port valve, as shown in Figure 1. For a canister, either the canister valve or an optional fine needle valve installed between the canister and the vent is used to adjust the canister flow rate to a value slightly higher than the trap flow rate set by the sample flow rate needle valve. The excess flow exhausts through the vent, which assures that the sample air flowing through the trap is at atmospheric pressure. The vent is connected to a flow indicator such as a rotameter as an indication of vent flow to assist in adjusting the flow control valve. Open the canister valve and adjust the canister valve or the sample flow needle valve to obtain a moderate vent flow as indicated by the rotameter. The sample flow rate will be lower (and hence the vent flow rate will be higher) when the the trap is cold.

11.4.7 Close the sample valve and open the vacuum valve (if not already open) to evacuate the vacuum reservoir. With the six-port valve in the inject position and the vacuum valve open, open the sample valve for 2-3 minutes [with both valves open, the pressure reading won't change] to flush and condition the inlet lines.

11.4.8 Close the sample valve and evacuate the reservoir to the predetermined sample starting pressure (typically 100 mm Hg) as indicated by the absolute pressure gauge.

11.4.9 Switch the six-port valve to the sample position.

11.4.10 Submerge the trap in the cryogen. Allow a few minutes for the trap to cool completely (indicated when the cryogen stops boiling). Add cryogen to the initial level used during system dynamic calibration. The level of the cryogenic liquid should remain constant with respect to the trap and should completely cover the beaded portion of the trap.

11.4.11 Open the sample valve and observe the increasing pressure on the pressure gauge. When it reaches the specific predetermined pressure (typically 300 mm Hg) representative of the desired sample volume (Section 11.2), close the sample valve.

11.4.12 Add a little cryogen or elevate the Dewar to raise the liquid level to a point slightly higher (3-15 mm) than the initial level at the beginning of the trapping. Note: This insures that organics do not bleed from the trap and are counted as part of the NMOC peak(s).

11.4.13 Switch the 6-port valve to the inject position, keeping the cryogenic liquid on the trap until the methane and upset peaks have deminished (10-20 seconds). Now close the canister valve to conserve the remaining sample in the canister.

11.4.14 Start the integrator and remove the Dewar flask containing the cryogenic liquid from the trap.

11.4.15 Close the GC oven door and allow the GC oven (or alternate trap heating system) to heat the trap at a predetermined rate (typically, 30°C/min) to 90°. Heating the trap provolatilizes the concentrated NMOC such that the FID produces integrated peaks. A uniform trap temperature rise rate (above 0°C) helps to reduce variability and facilitates more accurate correction for the moisture-shifted baseline. With a chromatograph oven to heat the trap, the following parameters have been found to be acceptable: initial temperature, 30°C; initial time, 0.20 minutes (following start of the integrator); heat rate, 30°/minute; final temperature, 90°C.

11.4.16 Use the same heating process and temperatures for both calibration and sample analysis. Heating the trap too quickly may cause an initial negative response that could hamper accurate integration. Some initial experimentation may be necessary to determine the optimal heating procedure for each system. Once established, the procedure should be consistent for each analysis as outlined in the user-prepared SOP Manual.

11.4.17 Continue the integration (generally, in the range of 1-2 minutes is adequate) only long enough to include all of the organic compound peaks and to establish the end point FID baseline, as illustrated in Figure 8. The integrator should be capable of marking the beginning and ending of peaks, constructing the appropriate operational baseline between the start and end of the integration period, and calculating the resulting corrected peak area. This ability is necessary because the moisture in the sample, which is also concentrated in the trap, will cause a slight positive baseline shift. This baseline shift starts as the trap warms and continues until all of the moisture is swept from the trap, at which time the baseline returns to its normal level. The shift always continues longer than the ambient organic peak(s). The integrator should be programmed to correct for this shifted baseline by ending the integration at a point after the last NMOC peak and prior to the return of the shifted baseline to normal (see Figure 8) so that the calculated operational baseline effectively compensates for the water-shifted baseline. Electronic integrators either do this automatically or they should be programmed to make this correction. Alternatively, analyses of humidified zero air prior to sample analyses should be performed to determine the water envelope and the proper blank value for correcting the ambient air concentration measurements accordingly. Heating and flushing of the trap should continue after the integration period has ended to insure all water has been removed to prevent buildup of water in the trap. Therefore, be sure that the 6-port valve remains in the inject position until all moisture has purged from the trap (3 minutes or longer).

11.4.18 Use the dynamic calibration curve (see Section 11.3) to convert the integrated peak area reading into concentration units (ppmC). Note that the NMOC peak shape may not be precisely reproducible due to variations in heating the trap, but the total NMOC peak area should be reproducible.

11.4.19 Analyze each canister sample at least twice and report the average NMOC concentration. Problems during an analysis occasionally will cause erratic or inconsistent results. If the first two analyses do not agree within ± 5% relative standard deviation (RSD), additional analyses should be made to identify inaccurate measurements and produce a more accurate average (see also Section 12.2.).

12. Performance Criteria and Quality Assurance

This section summarizes required quality assurance measures and provides guidance concerning performance criteria that should be achieved within each laboratory.

12.1 Standard Operating Procedures (SOPs)

12.1.1 Users should generate SOPs describing and documenting the following activities in their laboratory: (1) assembly, calibration, leak check, and operation of the specific sampling system and equipment used; (2) preparation, storage, shipment, and handling of samples; (3) assembly, leak-check, calibration, and operation of the analytical system, addressing the specific equipment used; (4) canister storage and cleaning; and (5) all aspects of of data recording and processing, including lists of computer hardware and software used.

12.1.2 SOPs should provide specific stepwise instructions and should be readily available to, and understood by, the laboratory personnel conducting the work.

12.2 Method Sensitivity, Accuracy, Precision and Linearity

12.2.1 The sensitivity and precision of the method is proportional to the sample volume. However, ice formation in the trap may reduce or stop the sample flow during trapping if the sample volume exceeds 500 cm^3. Sample volumes below about 100-150 cm^3 may cause increased measurement variability due to dead volume in lines and valves. For most typical ambient NMOC concentrations, sample volumes in the range of 200-400 cm^3 appear to be appropriate. If a response peak obtained with a 400 cm^3 sample is off scale or exceeds the calibration range, a second analysis can be carried out with a smaller volume. The actual sample volume used need not be accurately known if it is precisely repeatable during both calibration and analysis. Similarly, the actual volume of the vacuum reservoir need not be accurately known. But the reservoir volume should be matched to the pressure range and resolution of the absolute pressure gauge so that the measurement of the pressure change in the reservoir, hence the sample volume, is repeatable within 1%. A 1000 cm^3 vacuum reservoir and a pressure change of 200 mm Hg, measured with the specified pressure gauge, have provided a sampling precision of ± 1.31 cm^3. A smaller volume reservoir may be used with a greater pressure change to accommodate absolute pressure gauges with lower resolution, and vice versa.

12.2.2 Some FID detector systems associated with laboratory chromatographs may have autoranging. Others may provide attenuator control and internal full-scale output voltage selectors. An appropriate combination should be chosen so that an adequate output level for accurate integration is obtained down to the detection limit; however, the electrometer or integrator must not be driven into saturation at the upper end of the calibration. Saturation of the electrometer may be indicated by flattening of the calibration curve at high concentrations. Additional adjustments of range and sensitivity can be provided by adjusting the sample volume used, as discussed in Section 12.2.1.

12.2.3 System linearity has been documented (6) from 0 to 10,000 ppbC.

12.2.4 Some organic compounds contained in ambient air are "sticky" and may require repeated analyses before they fully appear in the FID output. Also, some adjustment may have to be made in the integrator off time setting to accommodate compounds that reach the FID late in the analysis cycle. Similarly, "sticky" compounds from ambient samples or from contaminated propane standards may temporarily contaminate the analytical system and can affect subsequent analyses. Such temporary contamination can usually be removed by repeated analyses of humidified zero air.

12.2.5 Simultaneous collection of duplicate samples decreases the possibility of lost measurement data from samples lost due to leakage or contamination in either of the canisters. Two (or more) canisters can be filled simultaneously by connecting them in parallel (see Figure 2(a)) and selecting an appropriate flow rate to accommodate the number of canisters (Section 10.2.2). Duplicate (or replicate) samples also allow assessment of measurement precision based on the differences between duplicate samples (or the standard deviations among replicate samples).

13. Method Modification

13.1 Sample Metering System

13.1.1 Although the vacuum reservoir and absolute pressure gauge technique for metering the sample volume during analysis is efficient and convenient, other techniques should work also.

13.1.2 A constant sample flow could be established with a vacuum pump and a critical orifice, with the six-port valve being switched to the sample position for a measured time period.

A gas volume meter, such as a wet test meter, could also be used to measure the total volume of sample air drawn through the trap. These alternative techniques should be tested and evaluated as part of a user-prepared SOP manual.

13.2 FID Detector System

13.2.1 A variety of FID detector systems should be adaptable to the method.

13.2.2 The specific flow rates and necessary modifications for the helium carrier for any alternative FID instrument should be evaluated prior to use as part of the user-prepared SOP manual.

13.3 Range

13.3.1 It may be possible to increase the sensitivity of the method by increasing the sample volume. However, limitations may arise such as plugging of the trap by ice.

13.3.2 Any attempt to increase sensitivity should be evaluated as part of the user-prepared SOP manual.

13.4 Sub-Atmospheric Pressure Canister Sampling

13.4.1 Collection and analysis of canister air samples at sub-atmospheric pressure is also possible with minor modifications to the sampling and analytical procedures.

13.4.2 Method TO-14, "Integrated Canister Sampling for Selective Organics: Pressurized and Sub-atmospheric Collection Mechanism," addresses sub-atmospheric pressure canister sampling. Additional information can be found in the literature (11-17).

1. Uses, Limitations, and Technical Basis of Procedures for Quantifying Relationships Between Photochemical Oxidants and Precursors, EPA-450/2-77-21a, U.S. Environmental Protection Agency, Research Triangle Park, NC, November 1977.

2. Guidance for Collection of Ambient Non-Methane Organic Compound (NMOC) Data for Use in 1982 Ozone SIP Development, EPA-450/4-80-011, U.S. Environmental Protection Agency, Research Triangle Park, NC, June 1980.

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7. R. D. Cox, et al., "Determination of Low Levels of Total Non-Methane Hydrocarbon Content in Ambient Air", Environ. Sci. Technol., 16 (1):57, 1982.

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9. F. W. Sexton, et al., A Comparative Evaluation of Seven Automated Ambient Non-Methane Organic Compound Analyzers, EPA-600/5482-046, U.S. Environmental Protection Agency, Research Triangle Park, NC, August 1982.

10. H. G. Richter, Analysis of Organic Compound Data Gathered During 1980 in Northeast Corridor Cities, EPA-450/4-83-017, U.S. Environmental Protection Agency, Research Triangle Park, NC, April 1983.

11. Cox, R. D. "Sample Collection and Analytical Techniques for Volatile Organics in Air," presented at APCA Speciality Conference, Chicago, Il, March 22-24, 1983.

12. Rasmussen, R. A. and Khalil, M.A.K. " Atmospheric Halocarbons: Measurements and Analyses of Selected Trace Gases," Proc. NATO ASI on Atmospheric Ozone, 1980, 209-231.

13. Oliver, K. D., Pleil J.D. and McClenny, W.A. "Sample Intergrity of Trace Level Volatile Organic Compounds in Ambient Air Stored in "SUMMA®" Polished Canisters," accepted for publication in Atmospheric Environment as of January 1986. Draft available from W. A. McClenny, MD-44, EMSL, EPA, Research Triangle Park, NC 27711.

14. McClenny, W. A. Pleil J.D. Holdren, J.W.; and Smith, R.N.; 1984. " Automated Cryogenic Preconcentration and Gas Chromatographic Determination of Volatile Organic Compounds," Anal. Chem. 56:2947.

15. Pleil, J. D. and Oliver, K. D., 1985, "Evaluation of Various Configurations of Nafion Dryers: Water Removal from Air Samples Prior to Gas Chromatographic Analysis". EPA Contract No. 68-02-4035.

16. Oliver, K. D.; Pleil, and McClenny, W. A.; 1986. "Sample Integrity of Trace Level Volatile Organic Compounds in Ambient Air Stored in Summa® Polished Canisters," Atmospheric Environ. 20:1403.

17. Oliver, K. D. Pleil, J. D., 1985, "Automated Cryogenic Sampling and Gas Chromatographic Analysis of Ambient Vapor-Phase Organic Compounds: Procedures and Comparison Tests," EPA Contract No. 68-02-4035, Research Triangle Park, NC, Northrop Services, Inc. - Environmental Sciences.

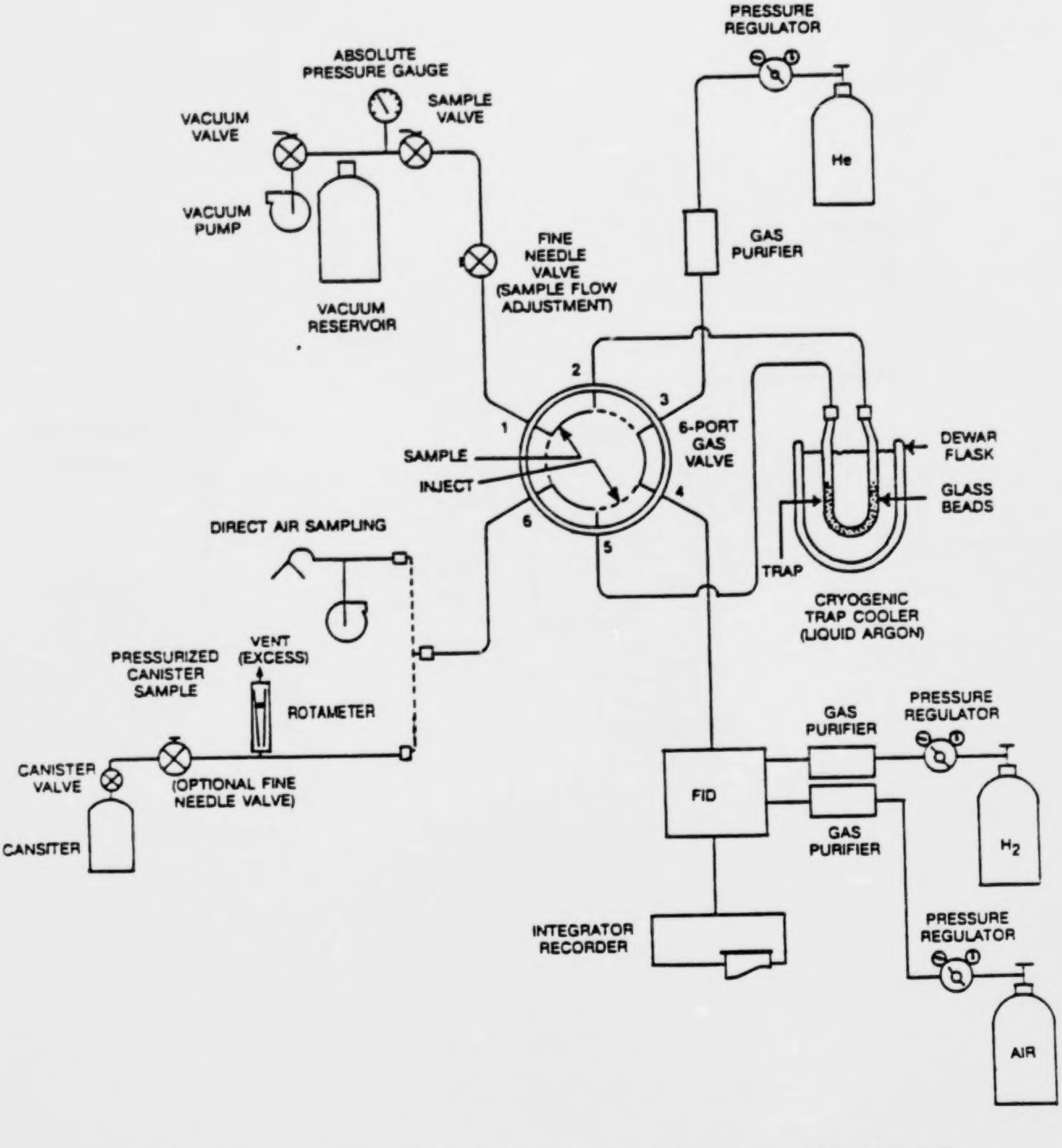

PRESSURE REGULATOR
ABSOLUTE PRESSURE GAUGE
SAMPLE VALVE
VACUUM VALVE
VACUUM PUMP
He
VACUUM RESERVOIR
FINE NEEDLE VALVE (SAMPLE FLOW ADJUSTMENT)
GAS PURIFIER
2
3
1
6-PORT GAS VALVE
SAMPLE
INJECT
4
6
5
DEWAR FLASK
GLASS BEADS
TRAP
CRYOGENIC TRAP COOLER (LIQUID ARGON)
DIRECT AIR SAMPLING
VENT (EXCESS)
PRESSURIZED CANISTER SAMPLE
ROTAMETER
CANISTER VALVE
(OPTIONAL FINE NEEDLE VALVE)
CANSITER
GAS PURIFIER
PRESSURE REGULATOR
FID
GAS PURIFIER
H2
PRESSURE REGULATOR
INTEGRATOR RECORDER
AIR

FIGURE 1. SCHEMATIC OF ANALYTICAL SYSTEM FOR NMOC—TWO SAMPLING MODES

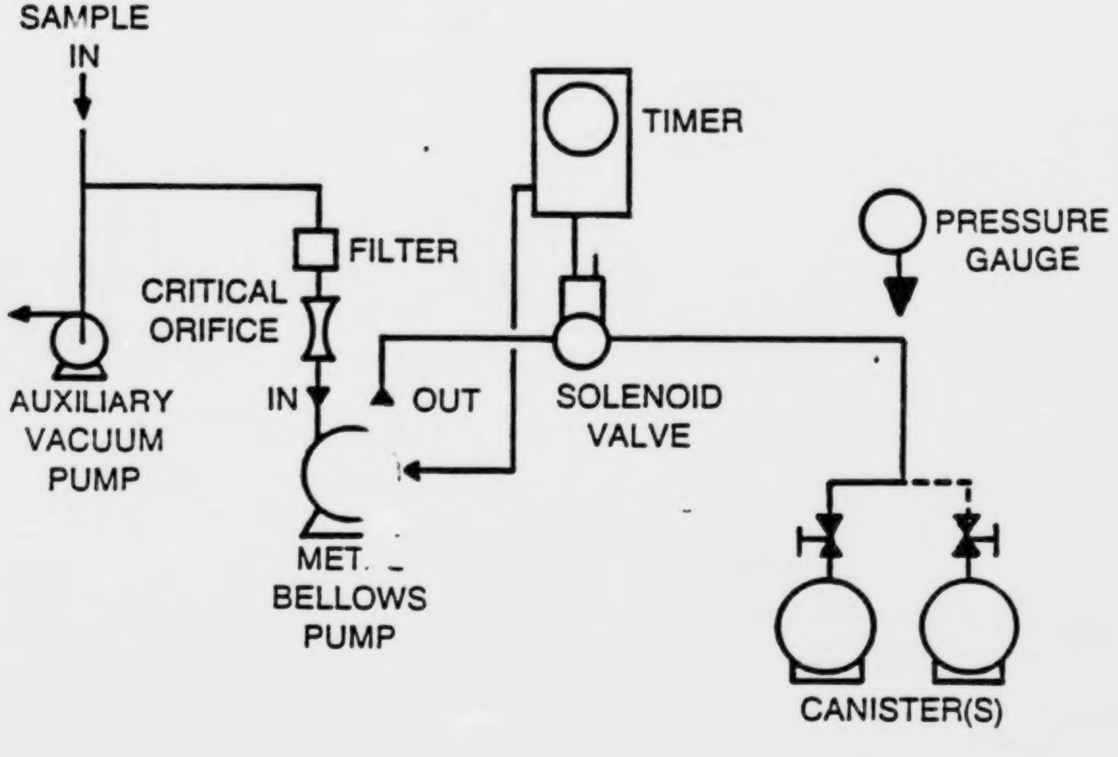
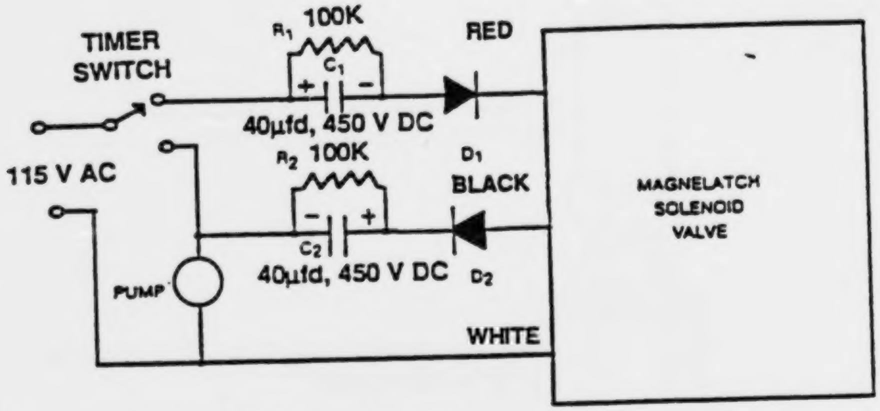

SAMPLE IN
TIMER
PRESSURE GAUGE
FILTER
CRITICAL ORIFICE
AUXILIARY VACUUM PUMP
IN
OUT
SOLENOID VALVE
METAL BELLOWS PUMP
CANISTER(S)

FIGURE 2. SAMPLE SYSTEM FOR AUTOMATIC COLLECTION OF 3-HOUR INTEGRATED AIR SAMPLES

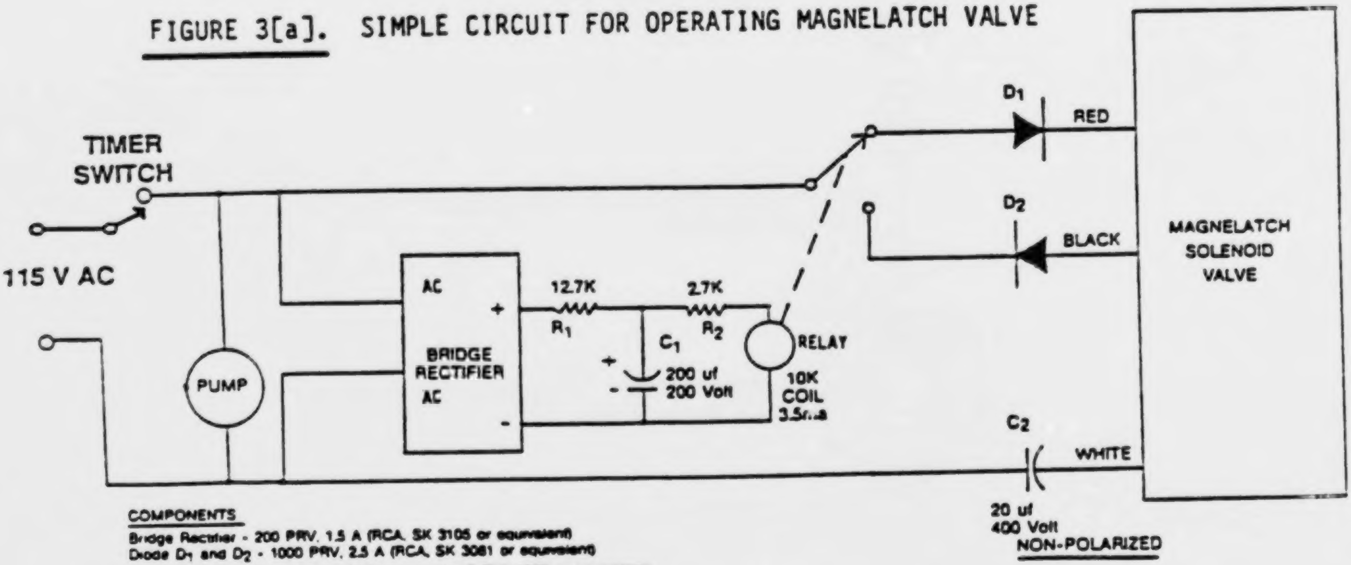
Reproduced from
best available copy


TIMER
SWITCH
115 V AC
R_1 100K
C_1
+
-
40µfd, 450 V DC
RED
D_1
R_2 100K
BLACK
-
+
C_2
40µfd, 450 V DC
D_2
PUMP
WHITE
MAGNELATCH
SOLENOID
VALVE

COMPONENTS

Capacitor C_1 and C_2 - 40 uf, 450 VDC (Sprague Atom® TVA 1712 or equivalent)
Resistor R_1 and R_2 - 0.5 watt, 5% tolerance
Diode D_1 and D_2 - 1000 PRV, 2.5 A (RCA, SK 3081 or equivalent)

FIGURE 3[a]. SIMPLE CIRCUIT FOR OPERATING MAGNELATCH VALVE


TIMER
SWITCH
115 V AC
PUMP
AC
+
BRIDGE
RECTIFIER
AC
-
12.7K
R_1
+
-
C_1
200 uf
200 Volt
2.7K
R_2
RELAY
10K
COIL
3.5 ma
D_1
RED
D_2
BLACK
MAGNELATCH
SOLENOID
VALVE
C_2
WHITE
20 uf
400 Volt
NON-POLARIZED

COMPONENTS

Bridge Rectifier - 200 PRV, 1.5 A (RCA, SK 3105 or equivalent)
Diode D_1 and D_2 - 1000 PRV, 2.5 A (RCA, SK 3081 or equivalent)
Capacitor C_1 - 200 uf, 250 VDC (Sprague Atom® TVA 1528 or equivalent)
Capacitor C_2 - 20 uf, 400 VDC Non-Polarized (Sprague Atom® TVAH 1852 or equivalent)
Relay - 10,000 ohm coil, 3.5 ma (AMF Potter and Brumfield, KCP 5, or equivalent)
Resistor R_1 and R_2 - 0.5 watt, 5% tolerance

FIGURE 3[b]. IMPROVED CIRCUIT DESIGNED TO HANDLE POWER INTERRUPTIONS

FIGURE 3. ELECTRICAL PULSE CIRCUITS FOR DRIVING SKINNER MAGNELATCH SOLENOID VALVE WITH A MECHANICAL TIMER

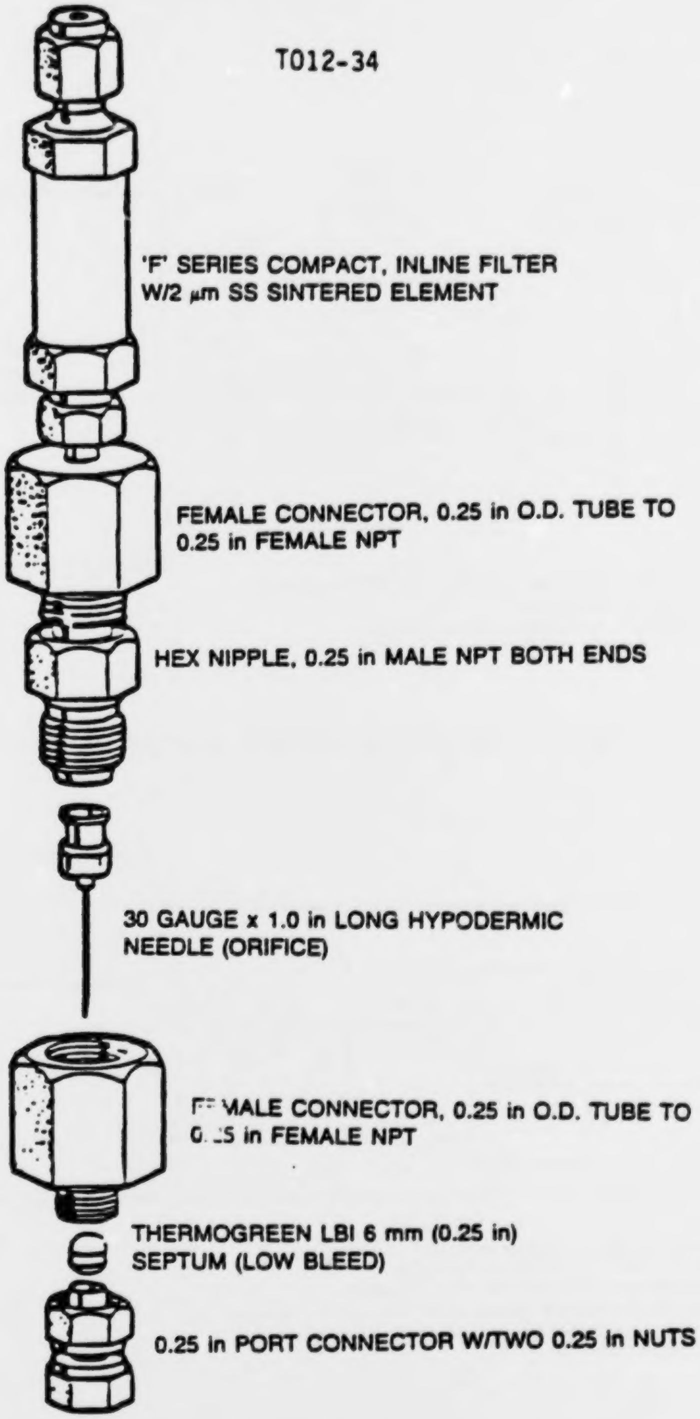

T012-34
'F' SERIES COMPACT, INLINE FILTER W/2 µm SS SINTERED ELEMENT
FEMALE CONNECTOR, 0.25 in O.D. TUBE TO 0.25 in FEMALE NPT
HEX NIPPLE, 0.25 in MALE NPT BOTH ENDS
30 GAUGE x 1.0 in LONG HYPODERMIC NEEDLE (ORIFICE)
FEMALE CONNECTOR, 0.25 in O.D. TUBE TO 0.25 in FEMALE NPT
THERMOGREEN LBI 6 mm (0.25 in) SEPTUM (LOW BLEED)
0.25 in PORT CONNECTOR W/TWO 0.25 in NUTS

FIGURE 4. FILTER AND HYPODERMIC NEEDLE ASSEMBLY FOR SAMPLE INLET FLOW CONTROL

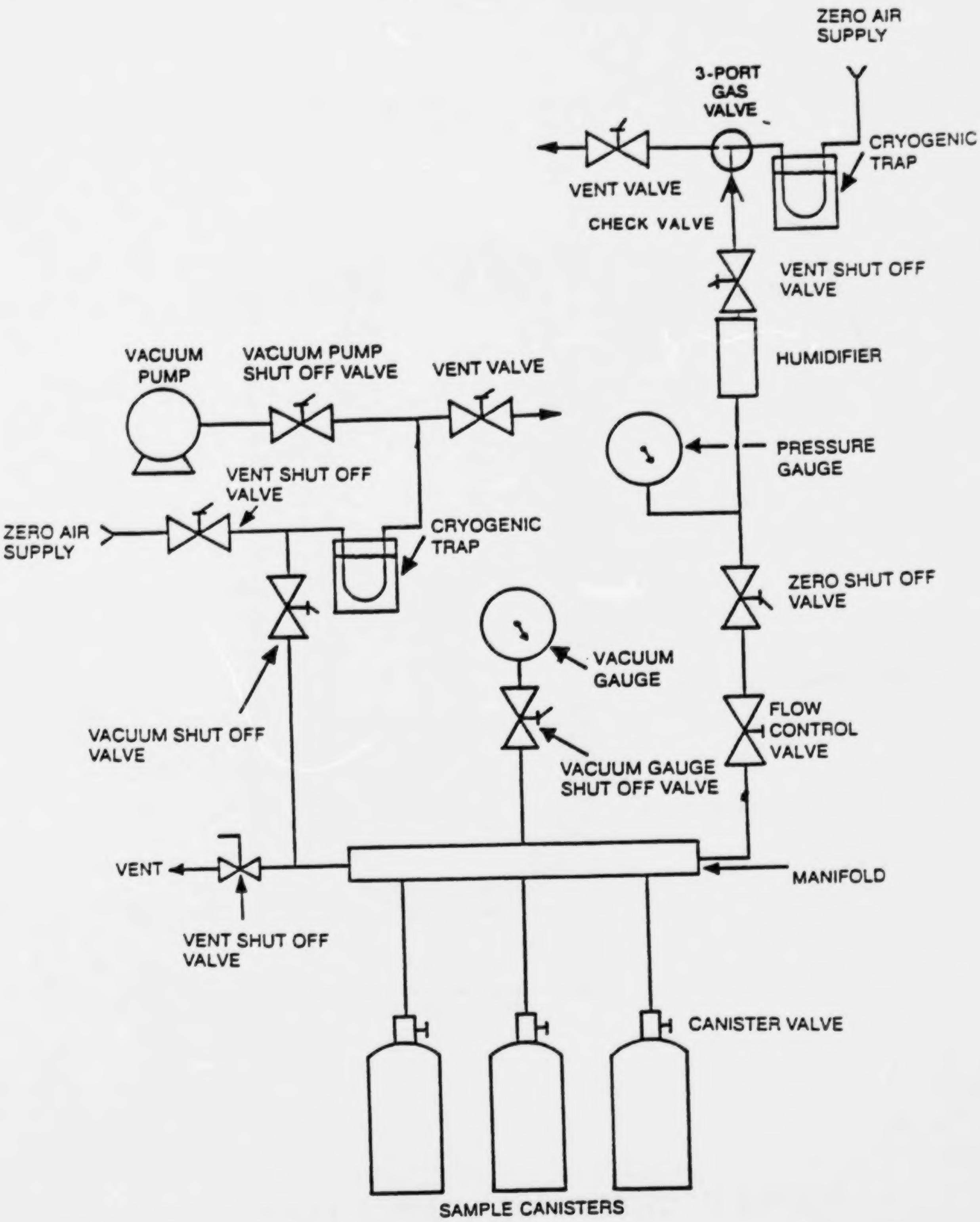

ZERO AIR SUPPLY
3-PORT GAS VALVE
CRYOGENIC TRAP
VENT VALVE
CHECK VALVE
VENT SHUT OFF VALVE
HUMIDIFIER
VACUUM PUMP
VACUUM PUMP SHUT OFF VALVE
VENT VALVE
PRESSURE GAUGE
VENT SHUT OFF VALVE
ZERO AIR SUPPLY
CRYOGENIC TRAP
ZERO SHUT OFF VALVE
VACUUM GAUGE
FLOW CONTROL VALVE
VACUUM SHUT OFF VALVE
VACUUM GAUGE SHUT OFF VALVE
VENT
MANIFOLD
VENT SHUT OFF VALVE
CANISTER VALVE
SAMPLE CANISTERS

FIGURE 5. CANISTER CLEANING SYSTEM

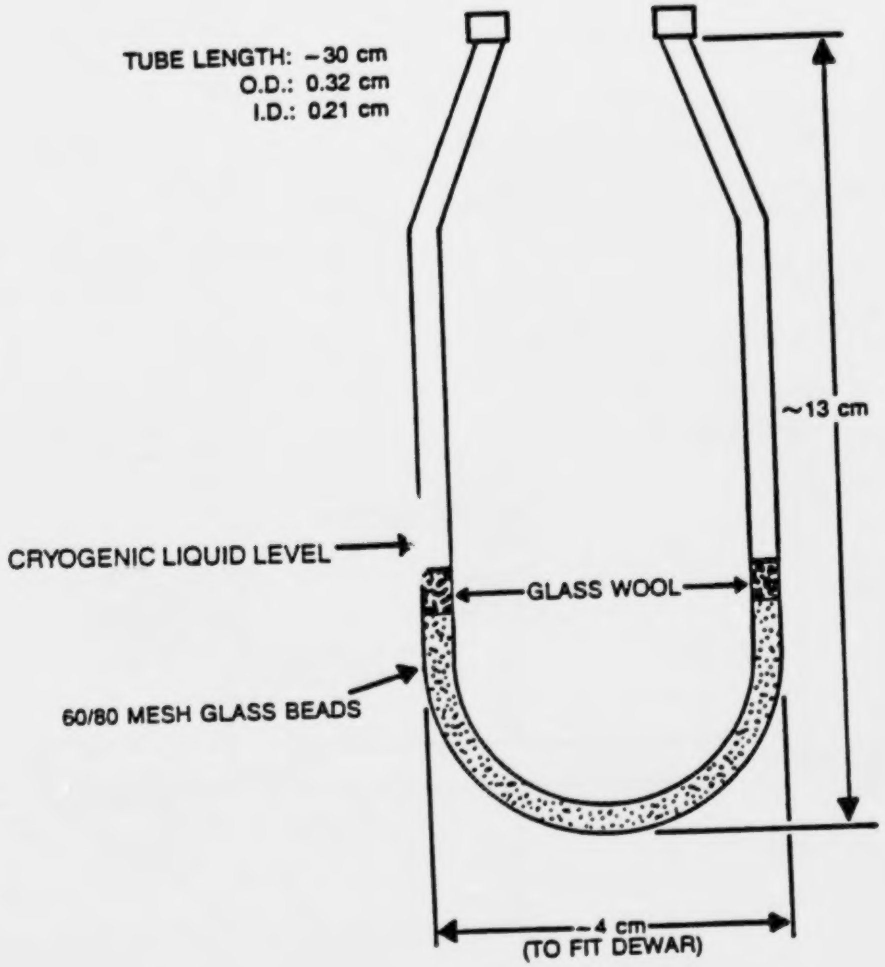

TUBE LENGTH: ~30 cm
O.D.: 0.32 cm
I.D.: 0.21 cm
~13 cm
CRYOGENIC LIQUID LEVEL
GLASS WOOL
60/80 MESH GLASS BEADS
4 cm
(TO FIT DEWAR)

FIGURE 6. CRYOGENIC SAMPLE TRAP DIMENSIONS

PRESSURIZED CANISTER SAMPLING DATA SHEET

GENERAL INFORMATION:

PROJECT: ______________________
SITE: ______________________
LOCATION: ______________________
MONITOR STATION NUMBER: ______________________
PUMP SERIAL NUMBER: ______________________

OPERATOR: ______________________
ORIFICE IDENTIFICATION: ______________________
FLOW RATE: ______________________
CALIBRATED BY: ______________________
LEAK CHECK ________ Pass ________ Fail

FIELD DATA:

			Sample Time		Average Atmospheric Conditions			Canister pressure Final, Laboratory		Comments
Date	Canister Serial Number	Sample Number	Start	Stop	Temperature	Pressure	Relative Humidity			

Date ______________________ Title ______________________ Signature ______________________

FIGURE 7. EXAMPLE SAMPLING DATA SHEET

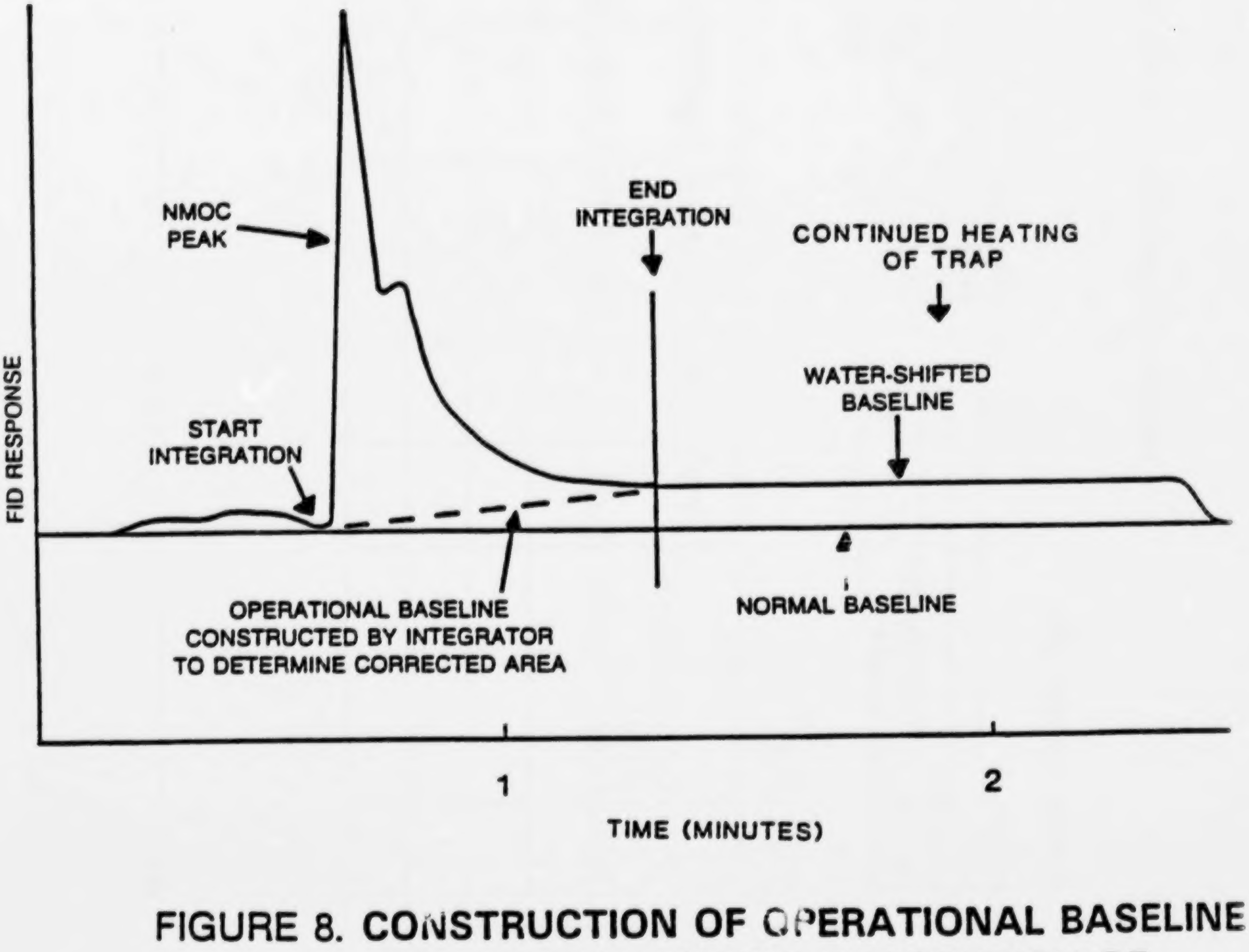


FIGURE 8. CONSTRUCTION OF OPERATIONAL BASELINE AND CORRESPONDING CORRECTION OF PEAK AREA

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C-10 Plot of NMOC concentration for Grand Rapids, MI C-28

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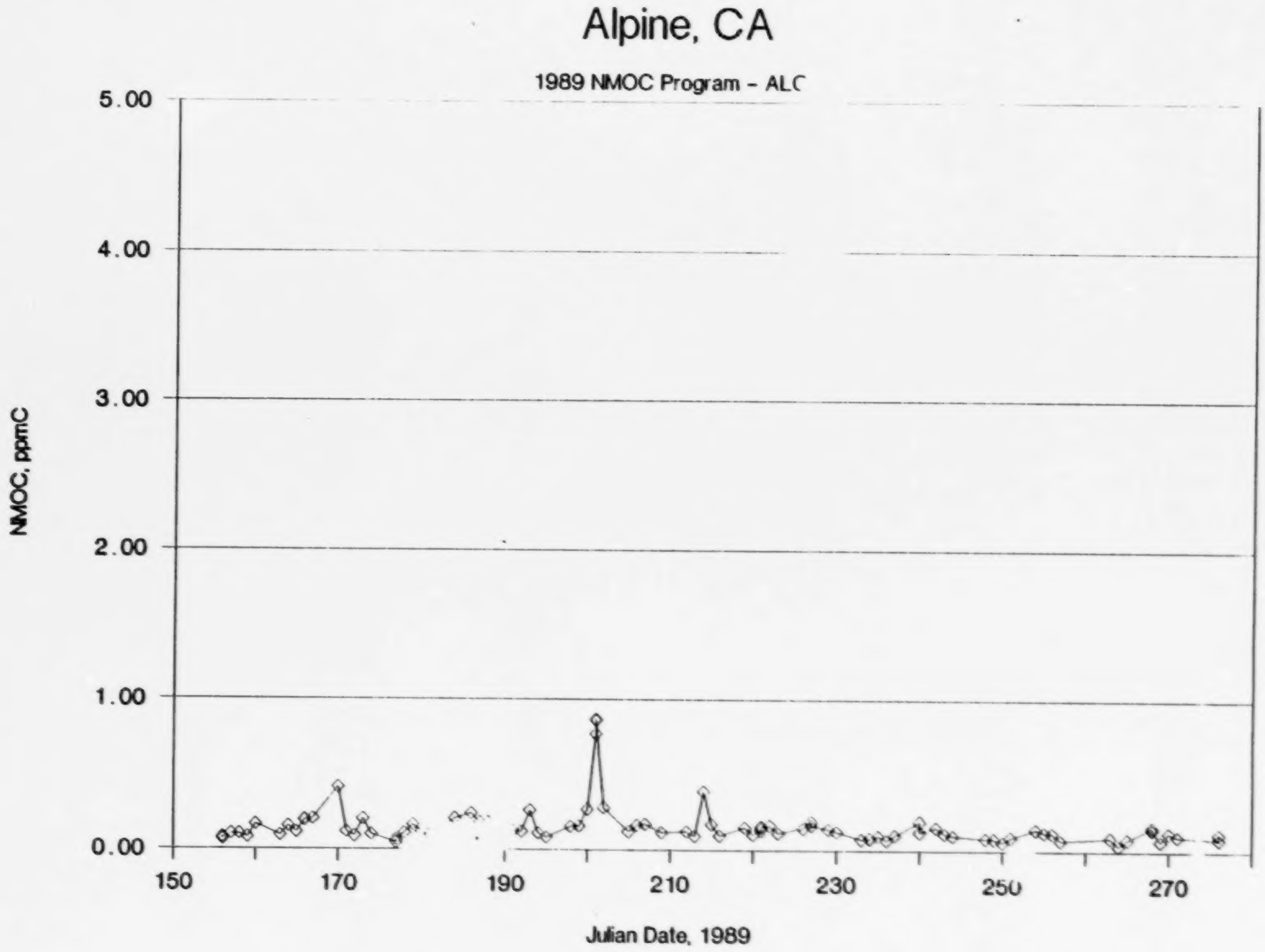

Figure C-1. Plot of NMOC concentration for Alpine, CA.

TABLE C-1. SUMMARY OF THE 1989 NMOC DATA FOR ALPINE, CA (ALCA)

Sampling Period: 9:00 a.m. to Noon

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC	QAD NMOC ppmc	AREAL NMOC ppmc
05-Jun-89	156	1016	98	15.9	15.0	B	0.069		
05-Jun-89	156	1017	72	15.9	16.0	C	0.065		
06-Jun-89	157	1033	825	15.0	14.0	B	0.101		
07-Jun-89	158	1060	672	16.0	16.0	B	0.101		
08-Jun-89	159	1091	97	14.5	14.0	B	0.080		
09-Jun-89	160	1109	899	15.0	14.0	D	0.163	0.203	
12-Jun-89	163	1133	645	16.0	15.0	A	0.093		
13-Jun-89	164	1181	407	15.0	14.0	D	0.155		
14-Jun-89	165	1183	87	15.0	14.0	D	0.112		
15-Jun-89	166	1231	406	16.5	13.5	A	0.196		
15-Jun-89	166	1232	707	16.5	13.5	A	0.195		
16-Jun-89	167	1240	726	16.0	12.0	A	0.201		
19-Jun-89	170	1270	75	14.2	10.0	C	0.414		
20-Jun-89	171	1273	39	15.0	14.0	D	0.115		
21-Jun-89	172	1301	718	15.5	15.0	B	0.087		
22-Jun-89	173	1359	899	15.0	14.0	C	0.203		
23-Jun-89	174	1365	155	15.0	14.0	D	0.097		
26-Jun-89	177	1385	53	17.0	16.0	B	0.046		
26-Jun-89	177	1386	850	17.0	16.0	C	0.066		
27-Jun-89	178	1400	640	11.0	12.0	D	0.109		
28-Jun-89	179	1426	672	15.5	15.0	C	0.163		
29-Jun-89	180	1453	914	15.5	15.0	A	0.115		
30-Jun-89	181	1478	36	16.0	15.0	A	0.101		
30-Jun-89	181	1479	501	16.0	15.0	A	0.079		
03-Jul-89	184	1516	136	15.0	13.0	B	0.209		
05-Jul-89	186	1510	765	15.0	14.0	C	0.242		
07-Jul-89	188	1594	921	14.0	12.0	C	0.180		
10-Jul-89	191	1609	773	14.0	12.0	B	0.121		
11-Jul-89	192	1628	307	14.0	15.0	D	0.117	0.160	
12-Jul-89	193	1681	775	14.5	12.0	A	0.262		
13-Jul-89	194	1701	770	15.0	14.0	B	0.110		
14-Jul-89	195	1725	13	14.0	14.0	A	0.081		
17-Jul-89	198	1742	833	15.0	14.0	A	0.155		
18-Jul-89	199	1784	626	14.5	14.0	A	0.156		
19-Jul-89	200	1807	804	14.5	20.0	A	0.269		
20-Jul-89	201	1817	123	16.5	16.0	B	0.771		
20-Jul-89	201	1818	153	16.5	16.0	C	0.862		
21-Jul-89	202	1861	924	10.5	10.0	D	0.281		
24-Jul-89	205	1884	84	14.0	15.0	D	0.122		
25-Jul-89	206	1906	713	16.0	14.0	D	0.162		
26-Jul-89	207	1927	406	15.0	15.0	C	0.172		
28-Jul-89	209	1984	698	15.5	16.0	D	0.115		
31-Jul-89	212	1994	857	15.0	15.0	D	0.123		
01-Aug-89	213	2024	27	15.0	14.0	A	0.093		
02-Aug-89	214	2059	109	16.5	16.0	C	0.390		
03-Aug-89	215	2086	640	16.0	16.0	D	0.171		

TABLE C-1. SUMMARY OF THE 1989 NMOC DATA FOR ALPINE, CA (ALCA)

Sampling Period: 9:00 a.m. to Noon

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC	QAD NMOC ppmc	AREAL NMOC ppmc
04-Aug-89	216	2112	825	15.0	14.0	C	0.096		
07-Aug-89	219	2124	669	16.0	15.0	D	0.152		
08-Aug-89	220	2155	878	15.0	14.0	A	0.104	0.128	
09-Aug-89	221	2178	304	16.0	15.0	A	0.155		
09-Aug-89	221	2177	677	16.0	16.0	A	0.158		
10-Aug-89	222	2200	148	9.0	9.0	D	0.164		
11-Aug-89	223	2232	786	16.0	16.0	D	0.111		
14-Aug-89	226	2260	618	10.0	10.0	C	0.147		
15-Aug-89	227	2309	11	14.5	14.0	A	0.163		
15-Aug-89	227	2279	837	15.0	14.0	A	0.191		
17-Aug-89	229	2344	774	15.5	14.0	A	0.141		
18-Aug-89	230	2341	661	15.5	14.0	C	0.124		
21-Aug-89	233	2391	815	15.0	14.5	D	0.074		
22-Aug-89	234	2418	38	15.0	14.0	D	0.078		
22-Aug-89	234	2417	146	15.0	14.0	D	0.081		
23-Aug-89	235	2440	675	14.5	14.0	D	0.096		
24-Aug-89	236	2452	671	15.0	15.0	D	0.067		
25-Aug-89	237	2487	104	14.0	14.0	B	0.102		
28-Aug-89	240	2563	97	14.5	14.0	C	0.122		
28-Aug-89	240	2526	793	15.5	15.0	C	0.193		
30-Aug-89	242	2538	916	14.5	14.0	D	0.154		
31-Aug-89	243	2591	126	14.5	12.0	A	0.111		
01-Sep-89	244	2627	89	14.5	14.0	D	0.097		
05-Sep-89	248	2635	11	14.5	14.0	B	0.082		
06-Sep-89	249	2654	43	15.0	14.0	B	0.080		
07-Sep-89	250	2730	718	15.5	15.0	B	0.056		
08-Sep-89	251	2728	84	13.0	14.0	C	0.090		
1 Sep-89	254	2743	71	15.0	14.0	B	0.144		
12-Sep-89	255	2773	801	15.0	14.0	D	0.123		
13-Sep-89	256	2795	16	14.0	13.0	C	0.118		
14-Sep-89	257	2807	31	14.5	14.0	B	0.070		
19-Sep-89	262	2903	22	14.0	14.0	A	0.063		
20-Sep-89	263	2898	50	14.5	14.0	B	0.091		
21-Sep-89	264	2944	801	15.0	14.0	C	0.038		
22-Sep-89	265	2974	25	14.0	14.0	B	0.080		
25-Sep-89	268	2984	62	15.0	14.0	B	0.147		
25-Sep-89	268	2983	652	15.0	15.0	A	0.159		
26-Sep-89	269	3019	767	15.0	14.0	C	0.068		
27-Sep-89	270	3028	52	14.0	14.0	A	0.122		
28-Sep-89	271	3075	639	15.3	15.0	D	0.098		
29-Sep-89	276	3098	697	15.5	16.0	D	0.116		
29-Sep-89	276	3097	872	15.5	16.0	B	0.082		

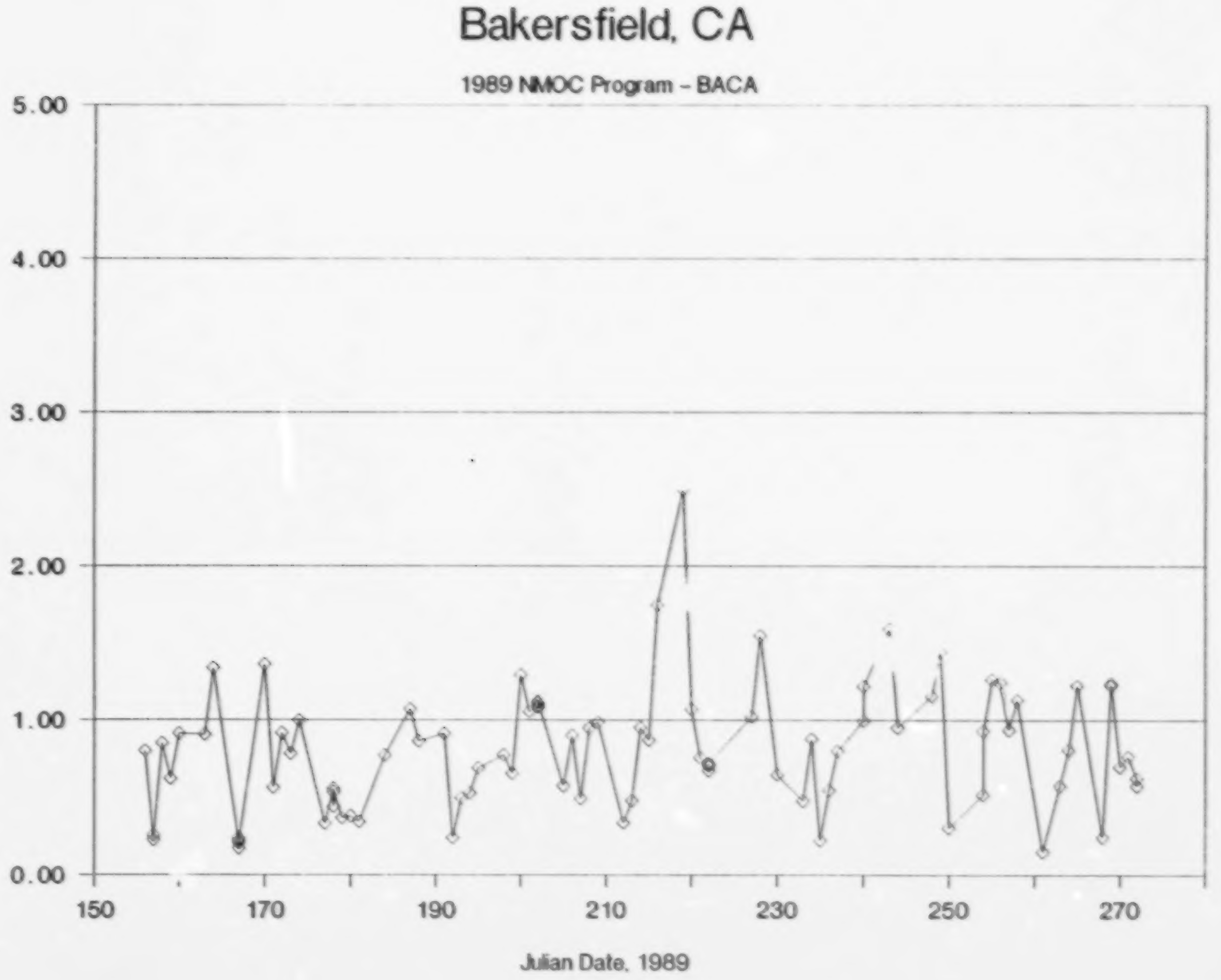

Figure C-2. Plot of NMOC concentration for Bakersfield, CA.

TABLE C-2. SUMMARY OF THE 1989 NMOC DATA FOR BAKERSFIELD, CA (BACA)

Sampling Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC	QAD NMOC ppmc	AREAL NMOC ppmc
05-Jun-89	156	1013	25	16.5	19.0	C	0.801	0.727	
06-Jun-89	157	1048	814			C	0.256		
06-Jun-89	157	1047	43		13.5	D	0.224		
07-Jun-89	158	1061	857	9.0	11.0	D	0.547		
08-Jun-89	159	1095	39	9.0	10.0	B	0.621		
09-Jun-89	160	1116	303	9.0	11.0	C	0.910		
12-Jun-89	163	1157	123	10.0	12.0	B	0.904		
13-Jun-89	164	1170	19	9.0	19.0	B	1.337		
16-Jun-89	167	1242	18	14.0	14.0	B	0.204		
16-Jun-89	167	1243	105	14.0	14.0	B	0.170		
19-Jun-89	170	1267	854	10.0	9.5	D	1.359		
20-Jun-89	171	1286	79	8.5	10.0	B	0.565		
21-Jun-89	172	1321	704	9.5	12.0	C	0.916		
22-Jun-89	173	1344	50	9.5	11.0	D	0.781		
23-Jun-89	174	1368	929	10.0	12.0	C	0.993		
26-Jun-89	177	1382	198	10.0	12.0	D	0.332		
27-Jun-89	178	1407	140	12.0	14.0	C	0.556		
27-Jun-89	178	1408	715	12.0	14.0	C	0.533		
28-Jun-89	179	1436	126	10.0	10.0	B	0.366		
29-Jun-89	180	1448	129	10.0	12.0	B	0.380	0.447	
30-Jun-89	181	1493	187	10.0	10.0	B	0.342		
03-Jul-89	184	1537	30	10.0	10.0	C	0.771		
06-Jul-89	187	1564	793	10.5	13.0	B	1.071		
07-Jul-89	188	1574	92	10.0	12.0	B	0.861	0.920	
07-Jul-89	188	1536	762	10.5	10.0	B	0.863		
10-Jul-89	191	1614	409	10[illegible]	10.0	D	0.909		
11-Jul-89	192	1643	868	10.0	11.0	D	0.238		
12-Jul-89	193	1653	190	10.0	10.0	A	0.497	0.556	
13-Jul-89	194	1691	713	11.0	11.0	B	0.528		
14-Jul-89	195	1714	148	10.0	12.0	B	0.690		
17-Jul-89	198	1739	169	10.0	12.0	A	0.775		
18-Jul-89	199	1768	21	10.0	12.0	D	0.655		
19-Jul-89	200	1787	38	10.0	11.0	C	1.290		
20-Jul-89	201	1830	689	11.0	11.0	D	1.053		
21-Jul-89	202	1851	74	13.0	15.0	D	1.090		
21-Jul-89	202	1852	815	13.0	15.0	B	1.121		
24-Jul-89	205	1868	17	10.0	12.0	C	0.575		
25-Jul-89	206	1890	659	10.0	12.0	B	0.898	1.068	
26-Jul-89	207	1923	403	10.0	9.0	C	0.494		
27-Jul-89	208	1949	677	10.0	13.0	C	0.947		
28-Jul-89	209	1979	828	10.0	12.0	D	0.985		
31-Jul-89	212	1998	789	11.0	12.0	C	0.336		
01-Aug-89	213	2020	642	11.0	13.0	A	0.479		
02-Aug-89	214	2040	306	10.0	10.0	C	0.950	1.008	
03-Aug-89	215	2075	705	10.5	12.0	A	0.868		
04-Aug-89	216	2101	924	10.0	12.0	D	1.746		

TABLE C-2. SUMMARY OF THE 1989 NMOC DATA FOR BAKERSFIELD, CA (BACA)

Sampling Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC	QAD NMOC ppmc	AREAL NMOC ppmc
07-Aug-89	219	2133	66	13.0	14.0	A	2.498		
08-Aug-89	220	2160	17	10.0	11.0	C	1.070		
09-Aug-89	221	2183	118	10.0	11.0	D	0.756		
10-Aug-89	222	2194	84	13.5	16.0	C	0.670		
10-Aug-89	222	2195	37	13.5	16.5	C	0.723		
15-Aug-89	227	2273	635	13.0	12.0	B	1.019		
16-Aug-89	228	2305	634	11.0	13.0	B	1.548		
17-Aug-89	229	2321	53	10.0	12.0	B	0.279		
18-Aug-89	230	2357	400	10.0	12.0	C	0.645	0.699	
21-Aug-89	233	2383	691	12.0	14.0	A	0.478		
22-Aug-89	234	2407	15	10.0	12.0	B	0.876		
23-Aug-89	235	2423	808	11.0	13.0	B	0.222		
24-Aug-89	236	2463	720	11.5	13.0	C	0.544		
25-Aug-89	237	2473	770	11.0	13.0	D	0.799		
28-Aug-89	240	2568	109		15.0	A	1.217		
28-Aug-89	240	2300	93		16.0	D	0.993		
31-Aug-89	243	2585	147	8.0	10.0	C	1.591		
01-Sep-89	244	2612	672	7.5	9.0	A	0.949		
05-Sep-89	248	2633	681	10.0	12.0	A	1.155		
06-Sep-89	249	2669	842	10.0	12.0	A	1.440		
07-Sep-89	250	2687	839	10.0	13.0	A	0.304		
11-Sep-89	254	2755	46	14.0	16.0	C	0.929		
11-Sep-89	254	2754	51	14.0	16.0	A	0.516		
12-Sep-89	255	2763	705	10.5	12.0	C	1.262		
13-Sep-89	256	2791	850	10.0	11.0	D	1.242		
14-Sep-89	257	2825	309	10.0	11.0	D	0.935		
15-Sep-89	258	2833	665	10.0	12.0	A	1.129		
18-Sep-89	261	2874	669	10.5	11.0	D	0.150		
20-Sep-89	263	2919	21	9.5	12.0	D	0.572		
22-Sep-89	265	2972	691	10.0	13.0	A	1.[illegible]1		
25-Sep-89	268	2992	131	10.0	12.0	C	0.[illegible]4		
26-Sep-89	269	3006	659	15.5	16.0	D	1.23[illegible]		
26-Sep-89	269	3005	673	15.5	16.0	A	1.222		
27-Sep-89	270	3038	623	9.0	12.0	D	0.697		
28-Sep-89	271	3058	63	9.0	11.0	C	0.763		
29-Sep-89	272	3105	665	13.5	14.0	B	0.624		
29-Sep-89	272	3106	123	13.5	16.0	D	0.572		

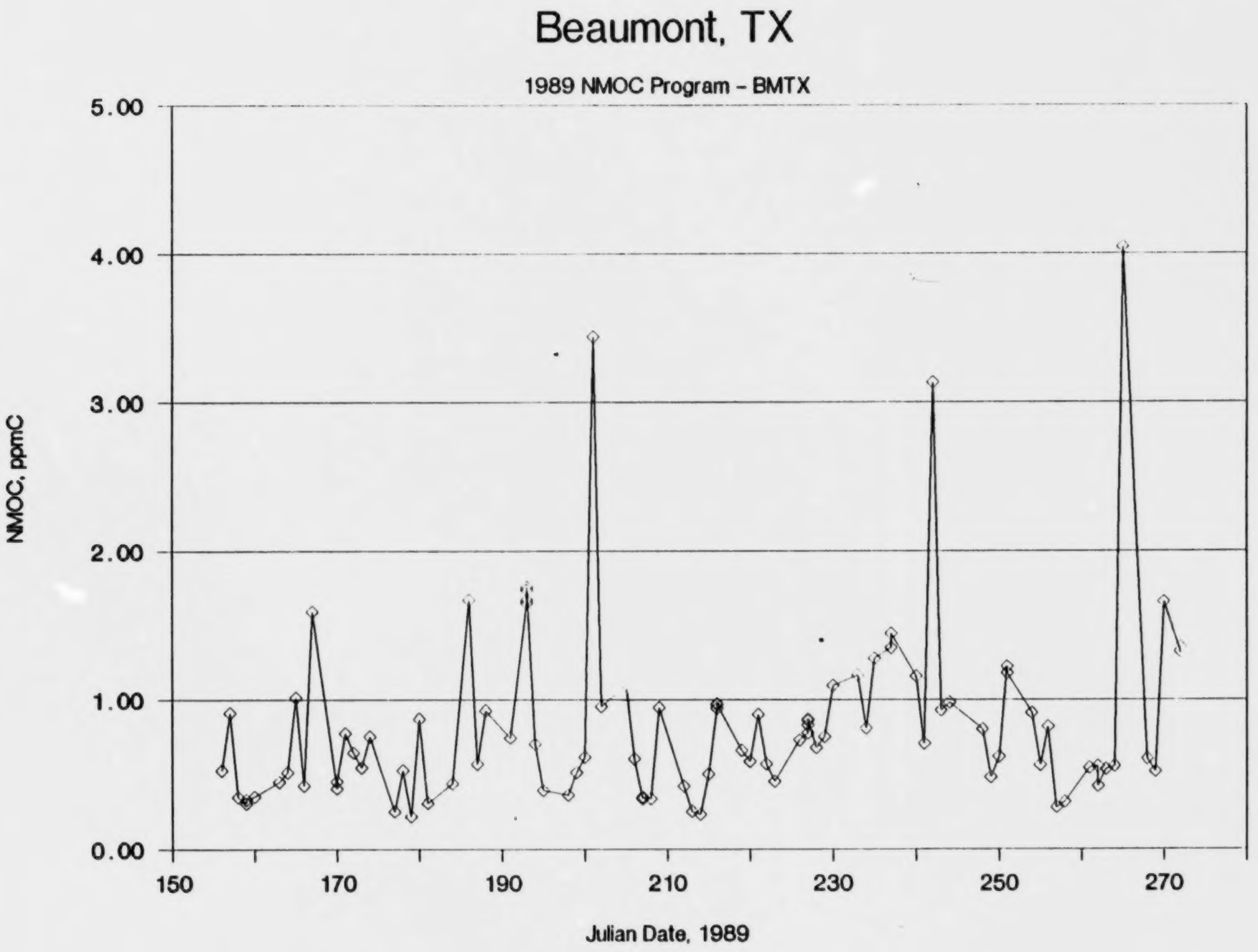

Figure C–3. Plot of NMOC concentration for Beaumont, TX.

TABLE C-3. SUMMARY OF THE 1989 NMOC DATA FOR BEAUMONT, TX (BMTX)

Sampling Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC	QAD NMOC ppmc	AREAL NMOC ppmc
05-Jun-89	156	1020	642	16.0	16.0	D	0.529		
06-Jun-89	157	1036	718	16.0	16.0	A	0.909		
07-Jun-89	158	1052	765	16.0	16.0	C	0.348		
08-Jun-89	159	1084	192	23.0	22.0	D	0.332		
08-Jun-89	159	1083	722	23.0	22.0	C	0.307		
09-Jun-89	160	1074	872	15.0	15.0	C	0.355	0.369	
12-Jun-89	163	1149	145	15.0	15.0	C	0.451		
13-Jun-89	164	1173	306	17.0	16.0	B	0.515		
14-Jun-89	165	1196	797	17.0	17.0	B	1.015		
15-Jun-89	166	1228	642	18.0	15.0	D	0.427		
16-Jun-89	167	1220	114	17.0	14.0	D	1.592		
19-Jun-89	170	1277	60	22.0	24.0	A	0.406		
19-Jun-89	170	1278	689	22.0	24.0	B	0.454		
20-Jun-89	171	1291	765	17.0	17.0	C	0.776		
21-Jun-89	172	1311	624	17.0	16.0	A	0.647		
22-Jun-89	173	1323	794	17.0	16.0	B	0.546		
23-Jun-89	174	1340	112	16.0	16.0	C	0.754		
26-Jun-89	177	1396	181	16.0	16.0	C	0.252		
27-Jun-89	178	1415	407	16.0	16.0	D	0.529		
28-Jun-89	179	1431	685	17.0	17.0	D	0.219		
29-Jun-89	180	1433	93	16.0	15.0	A	0.872		
30-Jun-89	181	1463	148	17.0	16.0	A	0.310		
03-Jul-89	184	1519	928	17.0	18.0	C	0.440		
05-Jul-89	186	1535	50	16.0	14.0	D	1.669		
06-Jul-89	187	1560	21	17.0	14.0	D	0.571		
07-Jul-89	188	1575	842	17.0	14.0	C	0.926		
10-Jul-89	191	1625	404	17.0	15.0	D	0.743		
12-Jul-89	193	1674	852	23.0	21.0	C	1.648		
12-Jul-89	193	1675	6	23.0	22.0	C	1.758		
13-Jul-89	194	1686	878	16.0	14.0	C	0.703		
14-Jul-89	195	1711	853	16.0	16.0	C	0.392	0.467	
17-Jul-89	198	1746	726	17.0	17.0	B	0.363		
18-Jul-89	199	1769	638	17.0	17.0	C	0.513		
19-Jul-89	200	1793	131		16.0	D	0.614		
20-Jul-89	201	1839	630	19.0	18.0	D	3.443	3.319	
21-Jul-89	202	1838	45	16.0	16.0	A	0.952		
24-Jul-89	205	1855	823	16.0	16.0	C	1.096		
25-Jul-89	206	1899	43	16.0	16.0	D	0.608		
26-Jul-89	207	1932	115	24.0	24.0	D	0.348		
26-Jul-89	207	1931	669	24.0	24.0	D	0.341		
27-Jul-89	208	1942	148	17.0	15.0	A	0.341	0.400	
28-Jul-89	209	1953	501	16.0	16.0	C	0.948		
31-Jul-89	212	1995	671	17.0	17.0	A	0.423		
01-Aug-89	213	2045	96	16.0	16.0	D	0.254	0.298	0.313
02-Aug-89	214	2043	53	16.0	15.0	C	0.232		
03-Aug-89	215	2072	166	16.0	17.0	A	0.503		

TABLE C-3. SUMMARY OF THE 1989 NMOC DATA FOR BEAUMONT, TX (BMTX)

Sampling Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC	QAD NMOC ppmc	AREAL NMOC ppmc
04-Aug-89	216	2090	151	22.0	22.0	C	0.965		
04-Aug-89	216	2089	162	22.0	22.0	C	0.966		
07-Aug-89	219	2103	685	17.0	16.0	C	0.663		
08-Aug-89	220	2162	622	18.0	16.0	B	0.586		
09-Aug-89	221	2187	765	17.0	17.0	C	0.902		
10-Aug-89	222	2220	189	16.0	16.0	B	0.569		
11-Aug-89	223	2204	86	16.0	16.0	B	0.454		
14-Aug-89	226	2249	20	16.0	16.0	B	0.730		
15-Aug-89	227	2281	32	21.0	21.0	B	0.863		
15-Aug-89	227	2280	142	21.0	21.0	B	0.831		
16-Aug-89	228	2266	156	15.0	14.0	C	0.681	0.755	0.793
17-Aug-89	229	2325	145		16.0	A	0.752		
18-Aug-89	230	2333	656	16.0	16.0	D	1.093		
21-Aug-89	233	2375	620	17.0	16.0	B	1.162		
22-Aug-89	234	2396	17	16.0	16.0	C	0.809		
23-Aug-89	235	2434	25	15.0	15.0	D	1.275		
25-Aug-89	237	2485	99	22.0	22.0	C	1.443	1.410	
25-Aug-89	237	2484	897	22.0	22.0	A	1.349		
28-Aug-89	240	2566	188	17.0	17.0	D	1.157		
29-Aug-89	241	2512	894	16.0	16.0	B	0.708		
30-Aug-89	242	2543	680	18.0	17.0	A	3.134		
31-Aug-89	243	2592	686	18.0	17.0	D	0.930		
01-Sep-89	244	2613	825	16.0	16.0	B	0.980		1.018
05-Sep-89	248	2637	100	17.0	16.0	B	0.802		0.916
06-Sep-89	249	265[illegible]	165	16.0	16.0	D	0.484		0.589
07-Sep-89	250	2684	649	18.0	18.0	D	0.621		
08-Sep-89	251	2690	176	23.0	23.0	A	1.223		
08-Sep-89	251	2691	192	23.0	23.0	B	1.179		
11-Sep-89	254	2753	929	17.0	17.0	D	0.910		
12-Sep-89	255	2746	774	18.0	17.0	D	0.566	0.590	0.676
13-Sep-89	256	2768	77	16.0	16.0	C	0.820		0.848
14-Sep-89	257	2805	99	16.0	16.0	C	0.282		0.371
15-Sep-89	258	2847	6	17.0	16.0	A	0.318		
18-Sep-89	261	2861	814	18.0	16.5	C	0.545		
19-Sep-89	262	2886	644	22.0	20.0	D	0.425		
19-Sep-89	262	2885	108	22.0	22.0	C	0.556		
20-Sep-89	263	2918	679	18.0	18.0	A	0.537		
21-Sep-89	264	2923	90	17.0	16.0	D	0.556		
22-Sep-89	265	2958	166	17.0	16.0	A	4.047		
25-Sep-89	268	2989	705	18.0	18.0	B	0.608		
26-Sep-89	269	3015	689	18.0	18.0	A	0.519		
27-Sep-89	270	3030	678	18.0	18.0	A	1.657		
29-Sep-89	272	3108	786	24.0	24.0	B	1.355		
29-Sep-89	272	3065	804	24.0	24.0	A	1.322		

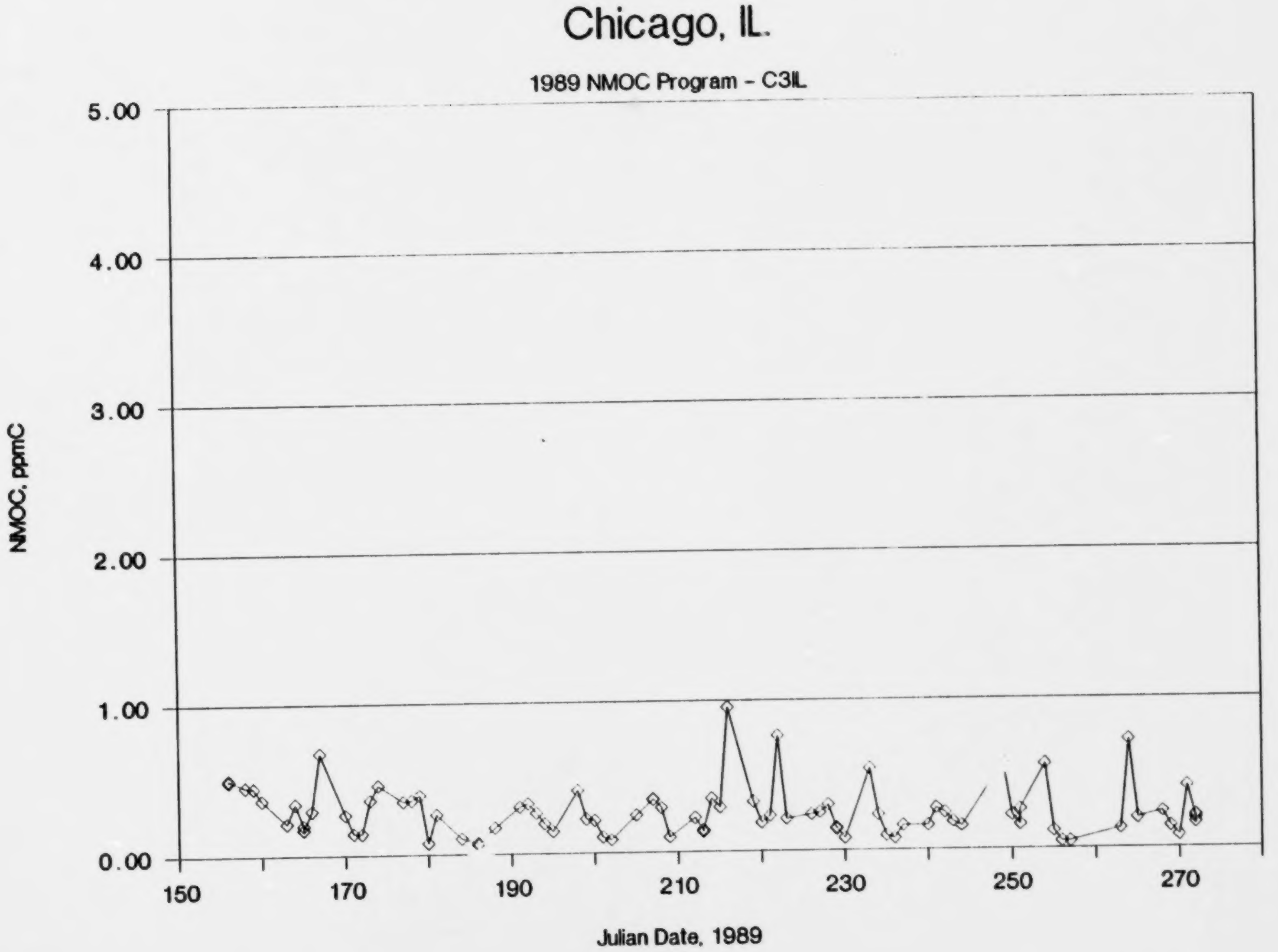

Figure C-4. Plot of NMOC concentration for Chicago, IL (Sears Tower).

TABLE C-4. SUMMARY OF THE 1989 NMOC DATA FOR CHICAGO, IL (C3IL)

Sampling Period: 6:00 a.m. to 9:00 a.m. Sampling Location: 90th Floor, Sears Tower

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC	QAD NMOC ppmc	AREAL NMOC ppmc
05-Jun-89	156	1043	115	17.0	16.0	B	0.493		
05-Jun-89	156	1044	171	17.0	16.0	C	0.504		
07-Jun-89	158	1073	679	12.0	11.0	D	0.454		
08-Jun-89	159	1094	91	12.0	11.0	A	0.448		
09-Jun-89	160	1085	17	12.0	10.0	D	0.369		
12-Jun-89	163	1136	883	12.0	10.0	D	0.214		
13-Jun-89	164	1174	8	12.0	10.0	A	0.343		
14-Jun-89	165	1194	649	19.0	18.0	A	0.171		
14-Jun-89	165	1193	685	19.0	18.0	C	0.199		
15-Jun-89	166	1216	307	12.0	8.0	C	0.296		
16-Jun-89	167	1255	928	12.0	8.0	B	0.676		
19-Jun-89	170	1252	814	12.0	8.0	D	0.268		
20-Jun-89	171	1280	676	12.0	10.0	C	0.142		
21-Jun-89	172	1326	17	11.0	9.0	C	0.140		
22-Jun-89	173	1334	13	11.8	9.0	C	0.363		
23-Jun-89	174	1332	813	12.0	10.0	C	0.460	0.390	
26-Jun-89	177	1384	627	12.0	10.0	A	0.354		
27-Jun-89	178	1402	147	11.0	10.0	C	0.359		
28-Jun-89	179	1421	176	11.0	9.0	D	0.393		
29-Jun-89	180	1476	675	12.0	10.0	C	0.076		
30-Jun-89	181	1473	783	12.0	12.0	D	0.265	0.357	
03-Jul-89	184	1496	897	12.0	8.0	C	0.104		
05-Jul-89	186	1555	165	18.0	16.0	C	0.058		
05-Jul-89	186	1554	661	18.0	16.0	A	0.070		
07-Jul-89	188	1593	837	11.0	10.0	B	0.175		
10-Jul-89	191	1601	621	12.0	8.0	C	0.312	0.264	
11-Jul-89	192	1632	20	10.0	8.0	B	0.332		
12-Jul-89	193	1699	105	11.0	8.0	B	0.271		
13-Jul-89	194	1696	673	12.0	8.0	C	0.200		
14-Jul-89	195	1754	766	12.0	10.0	C	0.147		
17-Jul-89	198	1748	675	12.0	10.0	C	0.417		
18-Jul-89	199	1804	96	11.0	10.0	D	0.224		
19-Jul-89	200	1797	825	11.0	10.0	C	0.217		
20-Jul-89	201	1816	774	12.0	12.0	A	0.103		
21-Jul-89	202	1871	661	12.0	11.0	C	0.084	0.133	
24-Jul-89	205	1870	775	12.0	11.0	C	0.248		
26-Jul-89	207	1934	71	18.0	16.0	D	0.350		
26-Jul-89	207	1933	720	18.0	17.0	D	0.348		
27-Jul-89	208	1951	925	12.0	11.0	B	0.294		
28-Jul-89	209	1964	622	12.0	11.0	D	0.098		
31-Jul-89	212	2028	666	12.0	11.0	C	0.225		
01-Aug-89	213	2018	45	20.0	17.0	B	0.138		
01-Aug-89	213	2019	658	20.0	17.0	B	0.142		
02-Aug-89	214	2046	36	11.0	10.0	D	0.352		
03-Aug-89	215	2088	783	12.0	11.0	B	0.291		
04-Aug-89	216	2123	630	13.0	12.5	D	0.953		

TABLE C-4. SUMMARY OF THE 1989 NMOC DATA FOR CHICAGO, IL (C3IL)

Sampling Period: 6:00 a.m. to 9:00 a.m. Sampling Location: 90th Floor, Sears Tower

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC	QAD NMOC ppmC	AREAL NMOC ppmc
07-Aug-89	219	2120	815	12.0	10.0	C	0.330		
08-Aug-89	220	2119	165	12.0	10.0	A	0.187	244	
09-Aug-89	221	2174	61	11.0	9.0	D	0.232		
10-Aug-89	222	2234	810	14.0	10.0	C	0.764		
11-Aug-89	223	2223	804	12.0	10.0	D	0.211		
14-Aug-89	226	2283	713	12.0	12.0	D	0.242		
15-Aug-89	227	2277	925	12.0	12.0	D	0.252		
16-Aug-89	228	2316	102	11.0	10.0	A	0.304		
17-Aug-89	229	2338	57	18.0	17.0	B	0.141		
17-Aug-89	229	2339	638	18.0	18.0	D	0.150		
18-Aug-89	230	2416	715	12.0	11.0	A	0.080		
21-Aug-89	233	2378	1	11.0	10.0	D	0.542		
22-Aug-89	234	2400	130	11.0	10.0	A	0.233		
23-Aug-89	235	2436	914	11.0	10.0	C	0.093		
24-Aug-89	236	2446	724	12.0	11.0	C	0.075		
25-Aug-89	237	2561	810	13.0	9.5	D	0.160		
28-Aug-89	240	2558	86	11.0	10.0	B	0.159		
29-Aug-89	241	2517	790	12.0	10.0	A	0.274		
30-Aug-89	242	2536	654	12.0	10.5	A	0.244		
31-Aug-89	243	2582	631	12.0	10.0	C	0.182		
01-Sep-89	244	2605	138	11.0	9.0	A	0.154		
06-Sep-89	249	2638	726	13.0	12.0	D	0.574		
06-Sep-89	249	2663	93	12.0	10.0	C	0.160		
07-Sep-89	250	2699	723	12.0	11.0	C	0.221		
08-Sep-89	251	2722	122	12.0	10.0	C	0.260		
11-Sep-89	254	2738	793	12.0	10.0	D	0.561		
12-Sep-89	255	2774	302	12.0	12.0	B	0.114		
13-Sep-89	256	2788	175	12.0	10.0	A	0.045		
14-Sep-89	257	2828	162	12.0	10.0	B	0.042		
20-Sep-89	263	2908	899	12.0	10.0	C	0.130		
21-Sep-89	264	2935	722	15.0	15.0	C	0.720		
22-Sep-89	265	2964	181	13.0	10.0	D	0.198		
25-Sep-89	268	2981	162	12.0	12.0	D	0.239		
26-Sep-89	269	3027	121	14.0	10.0	C	0.141		
27-Sep-89	270	3044	698	13.0	12.0	B	0.078		
28-Sep-89	271	3064	57		15.0	A	0.409		
29-Sep-89	272	3048	890		17.0	A	0.190		
.9-Sep-89	272	3049	38	14.0	18.0	C	0.209		

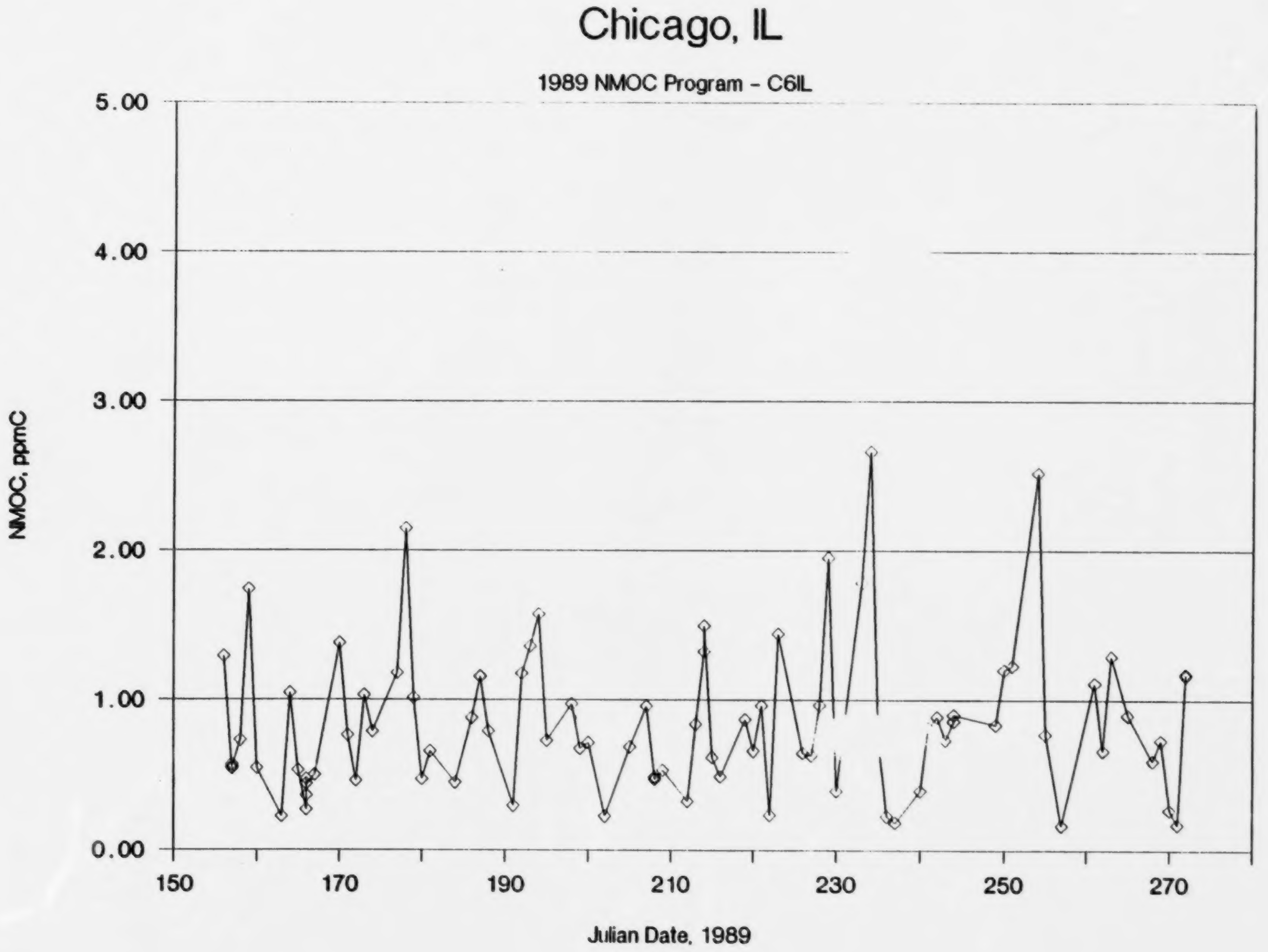

Figure C-5. Plot of NMOC concentration for Chicago, IL (CTA).

TABLE C-5. SUMMARY OF THE 1989 NMOC DATA FOR CHICAGO, IL (C6IL)

Sampling Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC	QAD NMOC ppmc	AREAL NMOC ppmc
05-Jun-89	156	1026	646	14.0	11.5	C	1.290	1.048	
06-Jun-89	157	1041	871	15.0	15.0	B	0.542		
06-Jun-89	157	1042	644	16.0	15.0	D	0.553		
07-Jun-89	158	1072	10	11.0	10.5	C	0.729		
08-Jun-89	159	1093	916	10.0	10.0	B	1.741		
09-Jun-89	160	1089	305	14.0	14.0	A	0.546		
12-Jun-89	163	1135	914	13.0	14.0	C	0.221		
13-Jun-89	164	1175	119	13.5	13.0	A	1.046		
14-Jun-89	165	1180	670	14.0	14.0	C	0.531	0.537	
15-Jun-89	166	1207	405	15.0	15.0	A	0.270		
15-Jun-89	166	1208	678	15.0	15.0	D	0.362		
16-Jun-89	167	1254	833	14.0	11.0	C	0.499		
19-Jun-89	170	1253	43	13.5	11.0	B	1.378		
20-Jun-89	171	1279	831	15.0	14.5	B	0.764		
21-Jun-89	172	1327	837	14.0	14.0	D	0.460		
22-Jun-89	173	1333	106	14.0	14.0	A	1.030		
23-Jun-89	174	1331	12	14.0	13.5	A	0.790		
26-Jun-89	177	1383	924	13.0	13.0	A	1.178		
27-Jun-89	178	1401	178	15.0	15.0	D	2.147		
28-Jun-89	179	1422	720	14.0	14.0	C	1.013		
29-Jun-89	180	1477	121	14.0	11.0	D	0.473		
30-Jun-89	181	1472	46	14.0	14.0	C	0.658	0.719	
03-Jul-89	184	1495	819	13.0	12.0	D	0.449		
05-Jul-89	186	1566	400	14.0	12.0	C	0.880		
06-Jul-89	187	1587	172	16.0	14.0	A	1.155		
06-Jul-89	187	1588	704	16.0	14.0	B	1.157		
07-Jul-89	188	1592	850	14.0	12.0	[illegible]	0.791		
10-Jul-89	191	1602	823	14.0	12.0	D	0.294	0.365	
11-Jul-89	192	1633	126	14.0	13.0	A	1.175		
12-Jul-89	193	1698	670	14.0	12.0	D	1.356		
13-Jul-89	194	1697	678	14.0	12.0	D	1.573		
14-Jul-89	195	1755	848	14.0	14.0	D	0.728		
17-Jul-89	198	1749	46	13.0	13.0	B	0.973		
18-Jul-89	199	1805	60	14.0	14.0	A	0.676		
19-Jul-89	200	1796	303	14.0	14.0	A	0.713		
21-Jul-89	202	1876	93	14.0	14.0	D	0.226		
24-Jul-89	205	1869	129	14.0	14.0	C	0.686		
26-Jul-89	207	1918	118	14.0	14.0	C	0.958		
27-Jul-89	208	1963	180	15.0	15.0	B	0.473		
27-Jul-89	208	1962	198	15.0	15.0	D	0.485		
28-Jul-89	209	1965	188	14.0	14.0	B	0.532		
31-Jul-89	212	2027	780	14.0	15.0	A	0.326		
01-Aug-89	213	2037	895	14.0	14.0	C	0.836		
02-Aug-89	214	2061	193	15.0	15.0	C	1.494		
02-Aug-89	214	2060	788	15.0	15.0	B	1.319		
03-Aug-89	215	2085	178	11.0	11.0	B	0.617		

TABLE C-5. SUMMARY OF THE 1989 NMOC DATA FOR CHICAGO, IL (C6IL)

Sampling Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC	QAD NMOC ppmc	AREAL NMOC ppmc
04-Aug-89	216	2122	692	11.0	11.0	B	0.489		
07-Aug-89	219	2121	153	11.0	10.0	D	0.868		
08-Aug-89	220	2118	113	14.0	12.0	C	0.659	0.718	
09-Aug-89	221	2173	697	15.0	15.0	C	0.960		
10-Aug-89	222	2231	673	15.0	15.0	B	0.234		
11-Aug-89	223	2224	50	14.0	12.0	D	1.442		
14-Aug-89	226	2282	27	14.0	14.0	C	0.645		
15-Aug-89	227	2276	928	14.0	13.0	C	0.628		
16-Aug-89	228	2317	406	14.0	15.0	C	0.963		
17-Aug-89	229	2331	853	14.0	14.0	D	1.952		
18-Aug-89	230	2415	839	13.0	14.0	B	0.397		
21-Aug-89	233	2389	807	16.0	16.0	D	1.781		
22-Aug-89	234	2401	630	17.0	16.0	C	2.663		
23-Aug-89	235	2437	868	13.0	14.0	C	0.733		
24-Aug-89	236	2447	302	14.0	14.0	D	0.225	0.271	
25-Aug-89	237	2560	929	14.0	15.0	A	0.182		
28-Aug-89	240	2557	687	17.0	17.0	B	0.394		
29-Aug-89	241	2518	46	13.0	14.0	D	0.811		
30-Aug-89	242	2535	673	14.0	15.0	D	0.889		
31-Aug-89	243	2581	691	14.0	14.0	B	0.732		
01-Sep-89	244	2606	19	13.0	12.0	A	0.859		
01-Sep-89	244	2661	129	13.0	14.0	A	0.901		
06-Sep-89	249	2637	796	14.0	15.0	B	0.833		
07-Sep-89	250	2695	644	14.0	15.0	D	1.200		
08-Sep-89	251	2721	178	15.0	15.0	B	1.227		
11-Sep-89	254	2739	786	14.0	14.0	D	2.520		
12-Sep-89	255	2776	104	14.0	14.0	C	0.771		
14-Sep-89	257	2818	301	14.0	14.0	C	0.164		
18-Sep-89	261	2877	161	14.0	13.5	D	1.113		
19-Sep-89	262	2902	17	14.0	14.0	B	0.664		
20-Sep-89	263	2907	184	14.0	14.0	D	1.290		
21-Sep-89	264	2926	626	13.0	11.0	C	0.126		
22-Sep-89	265	2971	188	14.0	14.0	A	0.896		
25-Sep-89	268	2982	301	14.0	15.0	A	0.596		
26-Sep-89	269	3041	306	12.0	15.0	A	0.730		
27-Sep-89	270	3043	662	14.0	16.0	B	0.268		
28-Sep-89	271	3073	51	14.0	11.0	D	0.170		
29-Sep-89	272	3071	628	14.0	17.0	B	1.175		
29-Sep-89	272	3072	702	14.0	17.0	D	1.162		

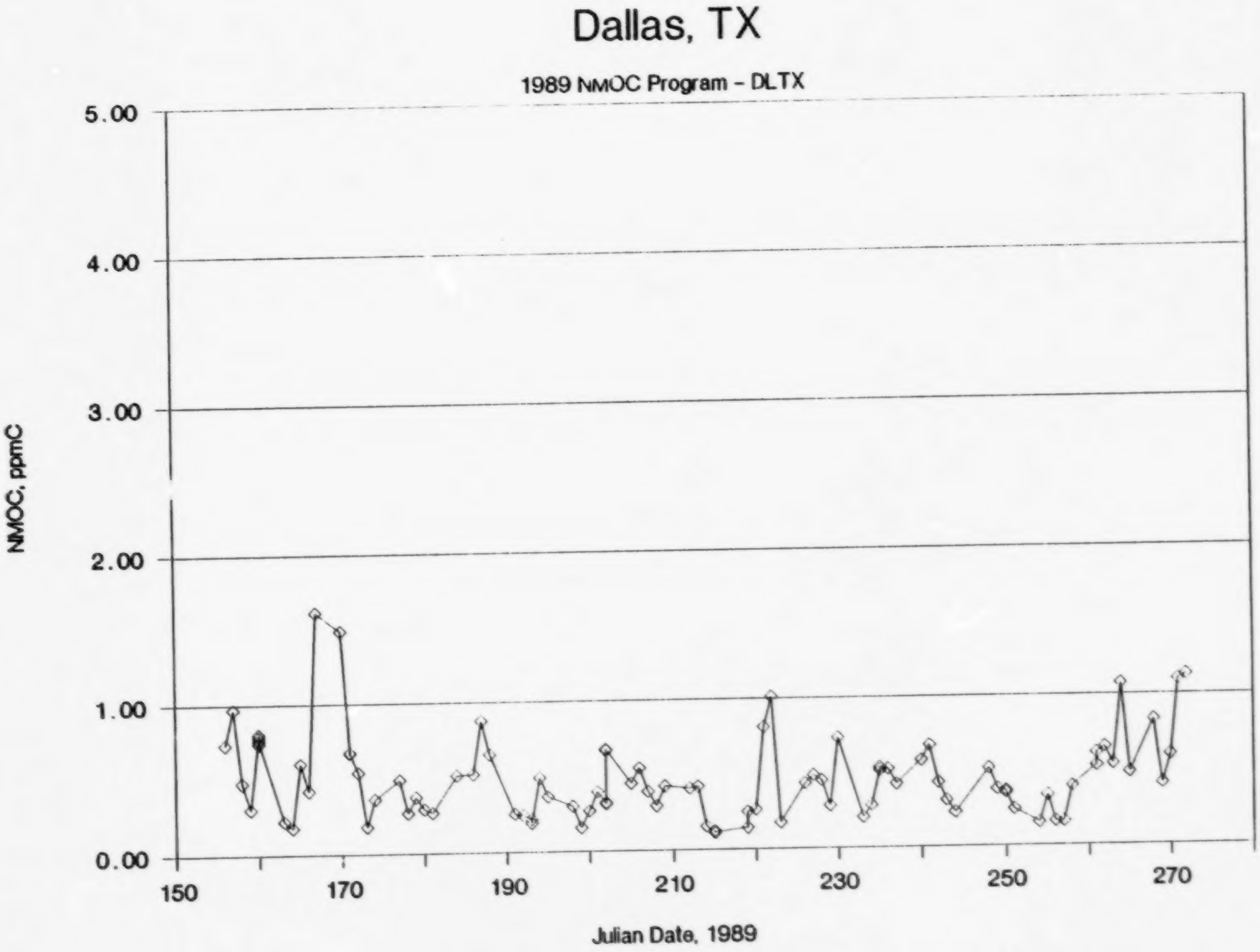

Figure C-6. Plot of NMOC concentration for Dallas, TX.

TABLE C-6. SUMMARY OF THE 1989 NMOC DATA FOR DALLAS, TX (DLTX)

Sampling Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC	QAD NMOC ppmc	AREAL NMOC ppmc
05-Jun-89	156	1028	56	15.0	16.0	A	0.734		
06-Jun-89	157	1062	620	16.0	16.0	A	0.967		
07-Jun-89	158	1098	924	16.0	15.5	A	0.477		
08-Jun-89	159	1117	193	15.0	15.5	A	0.302		
09-Jun-89	160	1132	93	15.0	16.0	D	0.760		
09-Jun-89	160	1131	900	15.0	16.0	D	0.802		
12-Jun-89	163	1201	618	16.0	17.0	D	0.222		
13-Jun-89	164	1190	768	17.0	16.5	D	0.178		
14-Jun-89	165	1217	668	17.0	14.0	C	0.605		
15-Jun-89	166	1234	157	15.0	14.0	C	0.423	0.450	
16-Jun-89	167	1268	56	15.0	14.0	A	1.611		
19-Jun-89	170	1294	162	17.0	16.0	D	1.486		
20-Jun-89	171	1309	30	17.0	17.0	A	0.673		
20-Jun-89	171	1310	622	17.0	17.0	C	0.672		
21-Jun-89	172	1328	143	16.0	16.0	A	0.541		
22-Jun-89	173	1367	724	17.0	16.0	D	0.179		
23-Jun-89	174	1390	679	16.0	18.0	D	0.361		
26-Jun-89	177	1428	669	17.0	17.0	A	0.488		
27-Jun-89	178	1430	33	16.0	16.0	D	0.271		
28-Jun-89	179	1467	623	18.0	18.0	B	0.375		
29-Jun-89	180	1499	137	15.0	15.0	D	0.292		
30-Jun-89	181	1521	162	16.0	16.0	B	0.271		
03-Jul-89	184	1545	4	16.0	15.0	A	0.514		
05-Jul-89	186	1556	899	16.0	15.0	D	0.522		
06-Jul-89	187	1583	659	18.0	16.0	C	0.876		
07-Jul-89	188	1620	100	15.0	14.0	C	0.651		
10-Jul-89	191	1639	22	[illegible]	14.0	A	0.252		
11-Jul-89	192	1670	788	17.0	17.0	D	0.244		
12-Jul-89	193	1705	686	16.0	18.0	C	0.190		
12-Jul-89	193	1704	894	16.0	18.0	C	0.215		
13-Jul-89	194	1717	42	15.0	16.0	C	0.494		
14-Jul-89	195	1738	723	16.5	17.0	B	0.366		
17-Jul-89	198	1767	39	15.0	16.0	B	0.301		
18-Jul-89	199	1789	72	16.0	16.0	B	0.158		
19-Jul-89	200	1829	808	17.0	17.0	C	0.266		
20-Jul-89	201	1854	920	15.5	16.0	A	0.394		
21-Jul-89	202	1888	3	15.0	16.0	D	0.668		
21-Jul-89	202	1887	126	15.0	16.0	B	0.316		
24-Jul-89	205	1891	98	15.0	16.0	A	0.446		
25-Jul-89	206	1920	635	17.0	18.0	D	0.549		
26-Jul-89	207	1943	91	16.0	15.0	B	0.390		
27-Jul-89	208	1987	181	16.0	16.5	C	0.296		
28-Jul-89	209	1997	156	16.0	16.0	B	0.426		
31-Jul-89	212	2036	786	16.0	17.0	A	0.411		
01-Aug-89	213	2044	104	15.0	16.0	A	0.421		
02-Aug-89	214	2065	823	16.0	15.0	A	0.151		

TABLE C-6. SUMMARY OF THE 1989 NMOC DATA FOR DALLAS, TX (DLTX)

Sampling Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC	QAD NMOC ppmC	AREAL NMOC ppmC
03-Aug-89	215	2116	670	17.0	17.5	D	0.116		
03-Aug-89	215	2115	704	17.0	18.0	B	0.114		
04-Aug-89	216	2137	656	16.0	17.0	C	0.141		
07-Aug-89	219	2166	628	16.0	17.0	D	0.247		
08-Aug-89	220	2186	197	16.0	16.0	C	0.260		
09-Aug-89	221	2206	42	16.5	17.0	C	0.808		
10-Aug-89	222	2238	71	17.0	16.0	B	1.009		
11-Aug-89	223	2245	644	18.0	18.0	B	0.173		
14-Aug-89	226	2268	140	16.0	16.0	C	0.433		
15-Aug-89	227	2293	652	17.0	17.0	D	0.487		
16-Aug-89	228	2335	788	17.5	17.0	C	0.452		
17-Aug-89	229	2355	658	17.0	17.0	B	0.284		
18-Aug-89	230	2385	77	16.0	16.0	C	0.732		
21-Aug-89	233	2402	870	[illegible]	16.0	C	0.202		
22-Aug-89	234	2424	864	[illegible]	16.0	A	0.280		
23-Aug-89	235	2456	702	16.5	18.0	A	0.530	0.545	
23-Aug-89	235	2455	789	16.5	18.0	A	0.515		
24-Aug-89	236	2475	185	16.0	14.0	D	0.523		
25-Aug-89	237	2493	684	16.0	17.0	B	0.420		
28-Aug-89	240	2507	192	16.0	16.0	C	0.577		
29-Aug-89	241	2548	72	16.0	16.0	A	0.675		
30-Aug-89	242	2589	77	15.0	16.0	B	0.427		
31-Aug-89	243	2622	114	16.0	16.0	D	0.307		
01-Sep-89	244	2644	792	17.0	16.0	A	0.227		0.312
05-Sep-89	248	2656	189	15.0	16.0	A	0.518		0.591
06-Sep-89	249	2692	838	15.0	16.0	D	0.378	0.443	0.459
07-Sep-89	250	2711	97	15.0	17.0	A	0.369		
07-Sep-89	250	2712	184	15.0	17.0	A	0.356		
08-Sep-89	251	2745	53	15.0	14.0	C	0.243	0.284	
11-Sep-89	254	2767	837	16.0	16.0	A	0.152		0.294
12-Sep-89	255	2787	137	15.0	16.0	A	0.334		
13-Sep-89	256	2804	113	15.0	16.0	B	0.160		0.250
14-Sep-89	257	2830	19	16.0	16.0	B	0.160		
15-Sep-89	258	2858	193	17.0	16.0	D	0.393		0.468
18-Sep-89	261	2889	164	16.0	16.0	C	0.612		
18-Sep-89	261	2888	91	16.0	16.4	C	0.527		
19-Sep-89	262	2917	304	17.0	17.0	B	0.651		
20-Sep-89	263	2920	11	16.0	16.0	C	0.540		
21-Sep-89	264	2965	45	16.0	16.0	C	1.074		
22-Sep-89	265	2993	107	16.0	16.0	D	0.484		
25-Sep-89	268	3016	309	16.0	16.0	D	0.832		
26-Sep-89	269	3035	857	17.0	16.0	D	0.408		
27-Sep-89	270	3070	800	17.0	18.0	C	0.598		
28-Sep-89	271	3099	670	17.5	18.0	D	1.097		
29-Sep-89	272	3116	305	16.0	16.0	D	1.129		

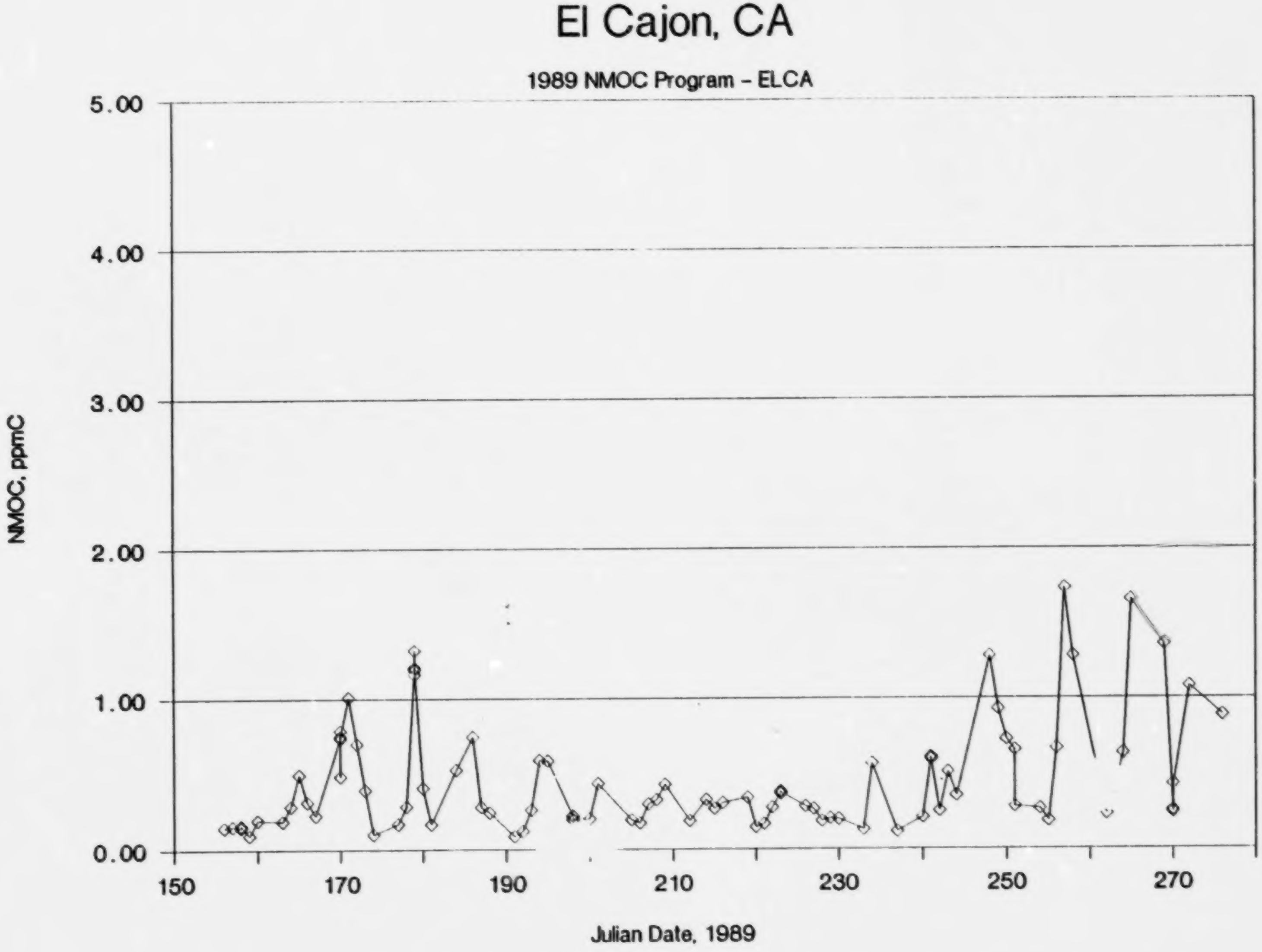

Figure C-7. Plot of NMOC concentration for El Cajon, CA.

TABLE C-7. SUMMARY OF THE 1989 NMOC DATA FOR EL CAJON, CA (ELCA)

Sampling Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC	QAD NMOC ppmc	AREAL NMOC ppmc
05-Jun-89	156	1011	666	14.0	14.0	D	0.147		
06-Jun-89	157	1037	623	14.2	15.0	A	0.152		
07-Jun-89	158	1066	676	16.0	16.0	C	0.152		
07-Jun-89	158	1067	780	16.2	16.0	C	0.148		
08-Jun-89	159	1092	790	13.5	14.0	B	0.092		
09-Jun-89	160	1110	663	11.0	11.0	C	0.194	0.241	
12-Jun-89	163	1134	182	13.0	14.0	C	0.187		
13-Jun-89	164	1182	680	14.2	14.0	A	0.287		
14-Jun-89	165	1184	772	14.0	14.0	B	0.497		
15-Jun-89	166	1218	828	13.0	11.0	C	0.315		
16-Jun-89	167	1241	674	14.0	12.0	D	0.225		
19-Jun-89	170	1259	806	16.0	12.0	B	0.486		
19-Jun-89	170	1258	644	16.0	14.0	A	0.738		
20-Jun-89	171	1274	844	14.0	14.0	A	1.008		
21-Jun-89	172	1302	309	14.5	15.0	A	0.699		
22-Jun-89	173	1351	22	14.0	14.0	D	0.397	0.430	
23-Jun-89	174	1366	860	13.5	14.0	C	0.101		
26-Jun-89	177	1387	663	14.2	14.0	A	0.169		
27-Jun-89	178	1399	894	13.0	14.0	C	0.286		
28-Jun-89	179	1424	49	19.0	20.0	D	1.205		
28-Jun-89	179	1423	164	19.0	20.0	C	1.321		
29-Jun-89	180	1452	770	17.0	18.0	C	0.411		
30-Jun-89	181	1486	43	16.0	16.0	B	0.165		
03-Jul-89	184	1517	645	16.2	17.0	B	0.528		
05-Jul-89	186	1511	638	16.5	18.0	D	0.746		
06-Jul-89	187	1549	193	15.5	15.0	A	0.282	0.319	
07-Jul-89	188	1595	929	16.5	15.0	D	0.245		
10-Jul-89	191	1610	900	16.0	15.0	A	0.088		
11-Jul-89	192	1627	173	16.0	15.0	C	0.122	0.134	
12-Jul-89	193	1680	672	16.5	17.0	D	0.262		
13-Jul-89	194	1700	64	16.0	15.0	B	0.592		
14-Jul-89	195	1724	63	15.5	16.0	A	0.587		
17-Jul-89	198	1751	8	15.0	16.0	C	0.197		
17-Jul-89	198	1750	838	15.0	16.0	A	0.219		
19-Jul-89	200	1806	618	19.0	14.0	C	0.202		
20-Jul-89	201	1827	100	15.0	14.0	C	0.437		
24-Jul-89	205	1877	719	16.0	17.0	D	0.195		
25-Jul-89	206	1905	31	15.5	16.0	B	0.174		
26-Jul-89	207	1928	165	16.0	16.0	A	0.301		
27-Jul-89	208	1926	107	15.5	16.0	A	0.330	0.357	
28-Jul-89	209	1983	400	15.5	16.0	C	0.429		
31-Jul-89	212	1992	60	15.0	16.0	D	0.189	0.230	
02-Aug-89	214	2058	772	16.5	17.0	D	0.328		
03-Aug-89	215	2087	92	15.0	16.0	D	0.271		
04-Aug-89	216	2111	722	16.5	17.0	D	0.305		
07-Aug-89	219	2125	129	16.5	16.0	A	0.342		

TABLE C-7. SUMMARY OF THE 1989 NMOC DATA FOR EL CAJON, CA (ELCA)

Sampling Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC	QAD NMOC ppmc	AREAL NMOC ppmc
08-Aug-89	220	2154	770	16.5	16.0	C	0.147	0.164	
09-Aug-89	221	2188	864	15.0	16.0	A	0.166		
10-Aug-89	222	2201	1	15.5	16.0	D	0.274		
11-Aug-89	223	2225	18	15.0	16.0	A	0.370		
11-Aug-89	223	2226	674	15.0	16.0	A	0.376		
14-Aug-89	226	2259	856	15.0	16.0	C	0.285		
15-Aug-89	227	2278	719	16.5	17.0	D	0.263		
16-Aug-89	228	2310	176	16.0	16.0	D	0.185		
17-Aug-89	229	2345	654	16.0	17.0	A	0.203		
18-Aug-89	230	2340	680	16.0	17.0	B	0.196		
21-Aug-89	233	2390	916	16.0	16.0	D	0.128		
22-Aug-89	234	2399	624	17.0	18.0	B	0.567		
25-Aug-89	237	2486	123	15.0	16.0	B	0.115	0.415	
28-Aug-89	240	2562	831	16.0	17.0	B	0.208		
29-Aug-89	241	2515	14	15.0	16.0	B	0.595		
29-Aug-89	241	2516	784	15.0	16.0	B	0.595		
30-Aug-89	242	2537	711	15.5	17.0	C	0.250		
31-Aug-89	243	2590	75	15.0	16.0	C	0.512		
01-Sep-89	244	2628	161	14.0	16.0	B	0.355		
05-Sep-89	248	[illegible]	38	21.0	22.0	A	1.280		
06-Sep-89	249	[illegible]	63	15.5	17.0	D	0.926		
07-Sep-89	250	2729	642		18.0	D	0.726		
08-Sep-89	251	2710	831	15.0	15.0	B	0.279		
08-Sep-89	251	2709	894	15.0	16.0	A	0.655		
11-Sep-89	254	2742	153	15.8	16.0	A	0.265		
12-Sep-89	255	2772	916	15.5	16.0	D	0.184		
13-Sep-89	256	2796	148	15.5	16.0	A	0.665		
14-Sep-89	257	2808	79	16.0	16.0	C	1.733		
15-Sep-89	258	2849	765	16.5	16.0	B	1.280		
19-Sep-89	262	2901	146	15.5	16.0	B	0.229		
20-Sep-89	263	2897	723	17.0	18.0	A	0.395		
21-Sep-89	264	2943	[illegible]	16.5	17.0	A	0.632		
22-Sep-89	265	2975	[illegible]	15.5	16.0	D	1.654		
26-Sep-89	269	3018	642	16.5	16.0	B	1.358		
27-Sep-89	270	3025	676	16.0	16.0	B	0.427		
27-Sep-89	270	3024	925	16.0	16.0	B	0.427		
28-Sep-89	272	3074	618	16.5	18.0	D	1.077		
29-Sep-89	276	3095	765	15.0	16.0	B	0.883		
29-Sep-89	276	3096	823	15.0	16.0	D	0.883		

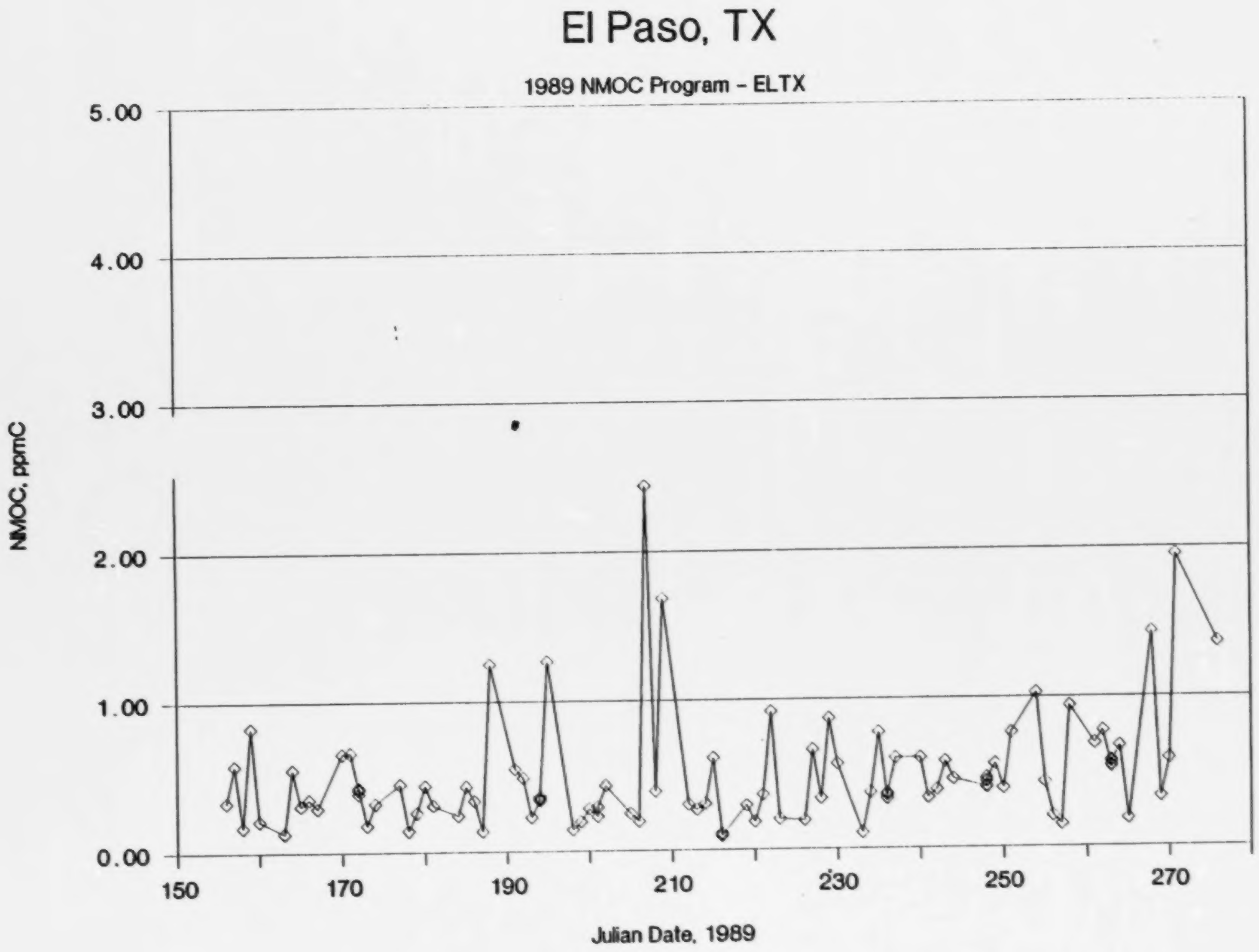

Figure C-8. Plot of NMOC concentration for El Paso, TX.

TABLE C-8. SUMMARY OF THE 1989 NMOC DATA FOR EL PASO, TX (ELTX)

Sampling Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC	QAD NMOC ppmc	AREAL NMOC ppmc
05-Jun-89	156	1038	60	11.0	9.0	A	0.331		
06-Jun-89	157	1030	114	11.0	9.0	A	0.579		
07-Jun-89	158	1055	131	10.0	8.0	D	0.165		
08-Jun-89	159	1080	789	11.0	10.0	B	0.826		
09-Jun-89	160	1104	181	9.5	8.0	C	0.209		
12-Jun-89	163	1146	112	14.0	13.0	A	0.125		
12-Jun-89	163	1145	197	14.0	13.0	A	0.126		
13-Jun-89	164	1155	705	11.0	9.0	B	0.551		
14-Jun-89	165	1198	501	10.0	10.0	C	0.310		
15-Jun-89	166	1238	770	10.5	6.0	C	0.355		
16-Jun-89	167	1237	662	10.0	6.0	D	0.293		
19-Jun-89	170	1269	675	10.0	7.0	C	0.655		
20-Jun-89	171	1284	864	11.0	10.0	A	0.661		
21-Jun-89	172	1304	774	14.5	13.0	C	0.389		
21-Jun-89	172	1303	895	14.5	13.0	B	0.416		
22-Jun-89	173	1347	1	11.0	10.0	D	0.176		
23-Jun-89	174	1348	96	11.0	10.0	C	0.324		
26-Jun-89	177	1388	900	11.0	10.0	D	0.453		
27-Jun-89	178	1414	768	12.0	10.0	D	0.141		
28-Jun-89	179	1427	189	11.0	10.0	D	0.262		
29-Jun-89	180	1465	105	11.0	10.0	C	0.440		
30-Jun-89	181	1489	662	11.0	10.0	D	0.309		
03-Jul-89	184	1505	112	11.0	10.0	D	0.242	0.360	
04-Jul-89	185	1533	634	12.0	9.0	C	0.434		
05-Jul-89	186	1534	184	11.0	10.0	D	0.339		
06-Jul-89	187	1538	68	13.0	13.0	A	0.134		
07-Jun-89	188	1598	309	11.0	10.0	A	1.247	1.306	
10-Jul-89	191	1618	7	11.0	8.0	C	0.549		
11-Jul-89	192	1640	777	12.0	10.0	A	0.488		
12-Jul-89	193	1659	197	11.0	11.0	D	0.227		
13-Jul-89	194	1702	304	14.5	14.0	C	0.340		
13-Jul-89	194	1703	796	14.5	14.0	D	0.348		
14-Jul-89	195	1718	75	11.0	10.0	C	1.266		
17-Jul-89	198	1747	161	8.0	10.0	D	0.144		
18-Jul-89	199	1766	780	12.0	10.5	C	0.195		
19-Jul-89	200	1786	162	11.0	9.5	D	0.283	0.345	
20-Jul-89	201	1823	409	15.0	14.0	B	0.230		
20-Jul-89	201	1824	772	15.0	15.0	C	0.292		
21-Jul-89	202	1840	20	11.0	10.0	C	0.436		
24-Jul-89	205	1867	875	12.0	10.0	D	0.248		
25-Jul-89	206	1898	113	8.0	10.0	C	0.194		
26-Jul-89	207	1897	806	12.0	13.0	C	2.442		
27-Jul-89	208	1971	776	9.0	12.0	B	0.396		
28-Jul-89	209	1982	42	13.0	11.0	D	1.683		
31-Jul-89	212	1999	804	12.0	10.5	A	0.303		
01-Aug-89	213	2032	686	12.0	11.0	C	0.271		

TABLE C-8. SUMMARY OF THE 1989 NMOC DATA FOR EL PASO, TX (ELTX)

Sampling Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC	QAD NMOC ppmc	AREAL NMOC ppmc
02-Aug-89	214	2049	135	11.0	10.0	C	0.308		
03-Aug-89	215	2042	108	12.0	11.0	D	0.612		
04-Aug-89	216	2092	303	14.0	13.0	C	0.092		
04-Aug-89	216	2091	626	14.0	13.0	C	0.106		
07-Aug-89	219	2140	180	12.0	10.0	D	0.295		
08-Aug-89	220	2148	803	12.0	11.0	D	0.186		
09-Aug-89	221	2161	801	13.0	10.0	D	0.365		
10-Aug-89	222	2216	780	12.5	11.0	C	0.918		
11-Aug-89	223	2215	169	11.0	10.0	A	0.201		
14-Aug-89	226	2251	309	12.0	10.0	D	0.191		
15-Aug-89	227	2274	123	12.0	10.0	C	0.661		
16-Aug-89	228	2294	665	12.0	10.0	C	0.339		
17-Aug-89	229	2328	899	12.0	10.0	D	0.869		
18-Aug-89	230	2353	12	12.0	10.5	A	0.568		
21-Aug-89	233	2380	164	11.5	10.0	D	0.105		
22-Aug-89	234	2386	711	12.5	12.0	C	0.375		
23-Aug-89	235	2430	150	11.5	10.0	C	0.775		
24-Aug-89	236	2445	162	14.5	12.5	B	0.358		
24-Aug-89	236	2444	148	14.5	13.0	A	0.357		
25-Aug-89	237	2476	309	12.0	10.0	D	0.601		
28-Aug-89	240	2495	674	12.5	12.0	C	0.601		
29-Aug-89	241	2511	652	12.5	10.5	C	0.333		
30-Aug-89	242	2546	640	12.0	10.5	C	0.387		
31-Aug-89	243	2602	137	11.5	10.0	C	0.578		
01-Sep-89	244	2615	661	12.0	10.0	D	0.458		
05-Sep-89	248	2643	695	15.0	13.0	D	0.464		
05-Sep-89	248	2642	914	15.0	13.0	C	0.403		
06-Sep-89	249	2652	772	12.5	14.0	C	0.555		
07-Sep-89	250	2678	108	11.5	10.0	D	0.395		
08-Sep-89	251	2685	171	12.0	10.0	B	0.763		
11-Sep-89	254	2748	711	12.0	10.0	B	1.029		
12-Sep-89	255	2762	75	11.0	10.0	D	0.433		
13-Sep-89	256	2797	138	12.0	10.0	C	0.204		
14-Sep-89	257	2826	685	12.5	11.0	B	0.148		
15-Sep-89	258	2823	631	12.5	11.0	A	0.937		
18-Sep-89	261	2859	697	12.0	10.0	D	0.687		
19-Sep-89	262	2904	15	11.0	10.0	A	0.770		
20-Sep-89	263	2939	84	15.0	13.0	D	0.531		
20-Sep-89	263	2938	684	15.0	13.0	D	0.538		
21-Sep-89	264	2921	929	12.0	10.0	D	0.669		
22-Sep-89	265	2960	680	12.0	11.0	C	0.184		
25-Sep-89	268	3001	900	12.0	10.0	A	1.430		
26-Sep-89	269	3008	668	12.0	11.0	D	0.331		
27-Sep-89	270	3034	178	13.0	12.0	C	0.585		
28-Sep-89	271	3060	837	12.0	11.0	A	1.950		
29-Sep-89	276	3092	108	12.0	10.0	C	1.359		

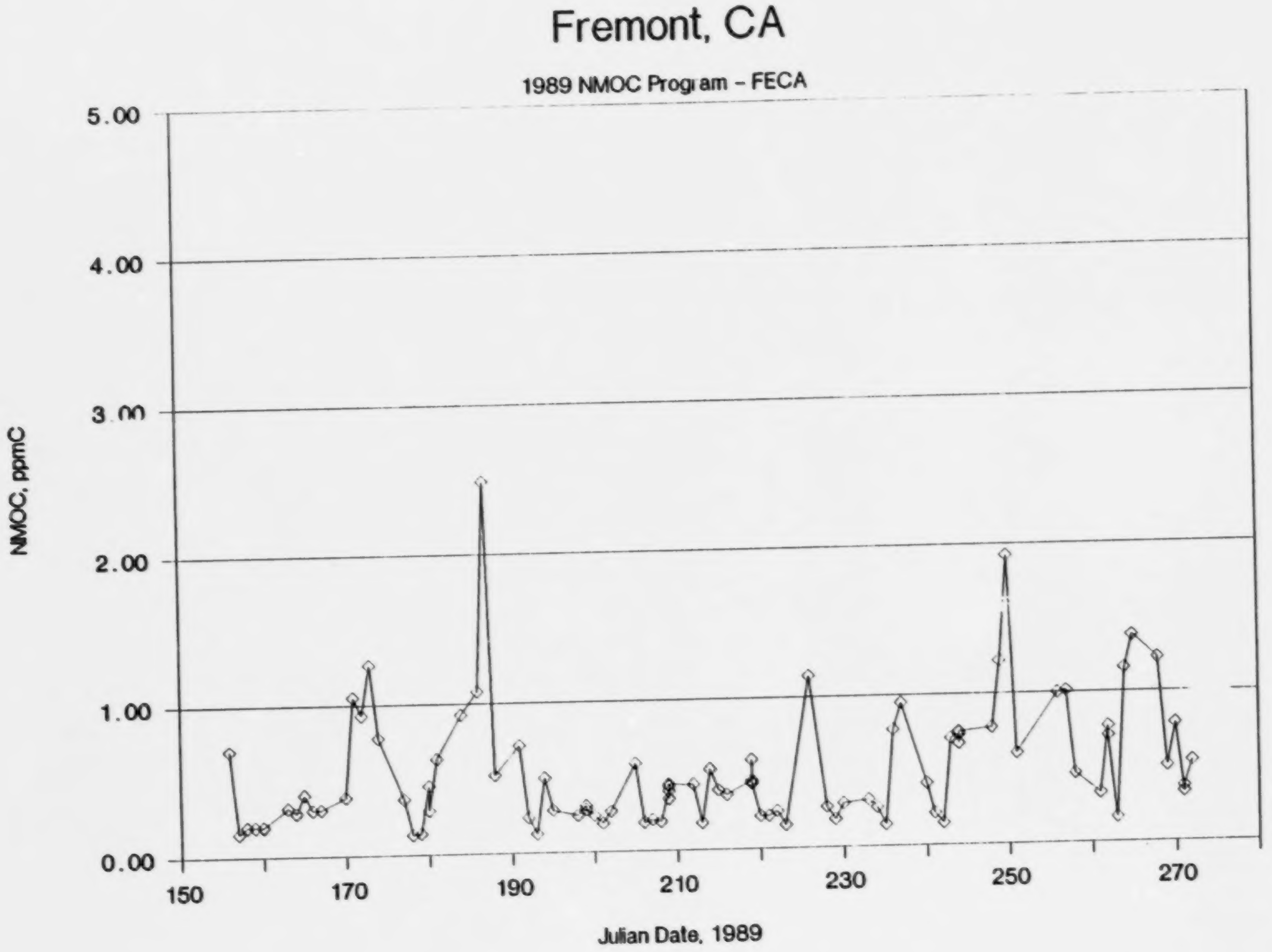

Figure C–9. Plot of NMOC concentration for Fremont, CA.

TABLE C-9. SUMMARY OF THE 1989 NMOC DATA FOR FREMONT, CA (FECA)

Sampling Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC	QAD NMOC ppmc	AREAL NMOC ppmc
05-Jun-89	156	1031	30	22.5	24.0	B	0.701		
06-Jun-89	157	1035	50	18.0	18.0	D	0.153		
07-Jun-89	158	1051	897	18.0	18.0	D	0.196	0.192	
08-Jun-89	159	1122	838	18.0	18.0	A	0.198		
09-Jun-89	160	1101	74	16.0	17.0	D	0.199		
09-Jun-89	160	1100	89	16.0	17.0	D	0.198		
12-Jun-89	163	1152	68	20.0	22.0	C	0.319		
13-Jun-89	164	1172	13	18.0	20.0	B	0.286		
14-Jun-89	165	1200	852	18.0	19.0	B	0.408		
15-Jun-89	166	1223	137	18.0	16.0	B	0.304		
16-Jun-89	167	1209	31	18.0	19.5	A	0.306	0.394	
19-Jun-89	170	1293	857	20.0	22.0	A	0.389		
21-Jun-89	172	1345	784	18.0	16.0	A	0.930		
22-Jun-89	173	1329	146	17.0	17.5	A	1.267		
23-Jun-89	174	1324	305	17.0	15.0	D	0.777		
26-Jun-89	177	1374	848	20.0	19.0	A	0.371	0.378	
27-Jun-89	178	1464	63	18.0	19.0	D	0.131		
28-Jun-89	179	1461	809	19.0	20.0	C	0.139		
29-Jun-89	180	1457	118	16.0	16.0	D	0.291		
29-Jun-89	180	1456	18	16.0	17.0	C	0.455		
30-Jun-89	181	1485	831	20.0	21.0	B	0.636		
03-Jul-89	184	1518	833	20.0	22.0	C	0.925		
05-Jul-89	186	1542	674	20.0	20.0	D	1.078		
06-Jul-89	187	1540	925	18.0	18.0	B	2.490	2.303	
07-Jul-89	188	1578	38	17.5	16.0	A	0.519		
10-Jul-89	191	1615	153	[illegible].0	20.0	C	0.713		
11-Jul-89	192	1638	37	17.5	15.0	C	0.232		
12-Jul-89	193	1657	657	19.0	19.0	B	0.124		
13-Jul-89	194	1692	631	18.5	18.0	D	0.498		
14-Jul-89	195	1719	25	17.0	19.0	A	0.282		
17-Jul-89	198	1734	637	20.5	22.0	A	0.245	0.300	
18-Jul-89	199	1781	674	16.0	18.0	D	0.283		
18-Jul-89	199	1780	914	16.0	18.0	A	0.307		
19-Jul-89	200	1795	10	17.5	18.0	A	0.240		
20-Jul-89	201	1842	104	17.5	18.0	B	0.189		
21-Jul-89	202	1834	819	17.5	18.0	A	0.268		
24-Jul-89	205	1874	687	21.0	22.0	B	0.581		
25-Jul-89	206	1894	102	17.5	18.0	B	0.189		
26-Jul-89	207	1922	854	17.5	19.0	A	0.206		
27-Jul-89	208	1946	171	17.5	19.0	B	0.190		
28-Jul-89	209	1985	157	13.0	14.0	A	0.396		
28-Jul-89	209	1986	305	16.0	17.0	B	0.343		
31-Jul-89	212	1993	660	21.0	21.0	C	0.434	0.407	
01-Aug-89	213	2035	839	18.0	19.0	D	0.176		
02-Aug-89	214	2054	618	19.0	20.0	A	0.534		
03-Aug-89	215	2074	719	18.5	20.0	D	0.393		

TABLE C-9. SUMMARY OF THE 1989 NMOC DATA FOR FREMONT, CA (FECA)

Sampling Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC	QAD NMOC ppmc	AREAL NMOC ppmc
04-Aug-89	216	2099	68	17.0	18.0	B	0.361	0.447	
07-Aug-89	219	2129	403	18.0	19.0	B	0.441		
07-Aug-89	219	2128	775	18.0	19.0	B	0.592		
08-Aug-89	220	2164	776	18.0	19.0	C	0.216		
09-Aug-89	221	2179	150	17.5	18.0	A	0.217		
10-Aug-89	222	2202	894	17.5	19.0	C	0.246		
11-Aug-89	223	2229	157	17.5	19.0	D	0.152		
14-Aug-89	226	2243	707	21.0	20.0	C	1.141	1.112	
16-Aug-89	228	2299	45	17.0	19.0	C	0.267		
17-Aug-89	229	2336	409	18.0	19.0	B	0.185	0.273	
18-Aug-89	230	2359	14	17.5	19.0	D	0.289		
21-Aug-89	233	2379	628	20.5	20.5	B	0.312		
22-Aug-89	234	2406	64	17.5	18.0	A	0.259		
23-Aug-89	235	2443	662	18.0	20.0	C	0.142		
24-Aug-89	236	2465	722	18.5	20.0	D	0.769		
25-Aug-89	237	2569	122	17.0	18.0	D	0.948		
28-Aug-89	240	2529	707	20.5	22.0	A	0.414		
29-Aug-89	241	2504	667	18.0	20.0	A	0.214		
30-Aug-89	242	2550	804	18.0	18.0	D	0.147		
31-Aug-89	243	2588	660	18.0	20.0	B	0.709		
01-Sep-89	244	2617	22	15.5	15.0	C	0.727		
01-Sep-89	244	2618	627	15.5	16.0	C	0.672		
05-Sep-89	248	2623	146	21.0	22.0	C	0.776	0.659	
06-Sep-89	249	2664	768	18.5	20.0	C	1.217		
07-Sep-89	250	2689	96	17.5	19.0	D	1.920		
08-Sep-89	251	2715	674	18.0	20.0	D	0.601		
13-Sep-89	256	2800	640	18.0	18.0	B	1.001		
14-Sep-89	257	2821	27	17.0	18.0	D	1.011		
15-Sep-89	258	2841	885	17.5	18.0	A	0.462		
18-Sep-89	261	2867	409	20.0	20.0	D	0.329		
19-Sep-89	262	2883	176	16.0	18.0	C	0.769		
19-Sep-89	262	2884	697	16.0	18.0	D	0.707		
20-Sep-89	263	2922	790	18.0	20.0	C	0.164		
21-Sep-89	264	2924	61	17.5	19.0	C	1.158		
22-Sep-89	265	2973	773	18.0	20.0	C	1.376		
25-Sep-89	268	2990	86	13.5	14.0	C	1.224		
26-Sep-89	269	3031	631	17.0	20.0	D	0.502		
27-Sep-89	270	3063	660	18.0	20.0	B	0.783		
28-Sep-89	271	3113	677	17.0	17.0	C	0.364		
28-Sep-89	271	3112	677	17.0	18.0	B	0.330		
29-Sep-89	272	3117	897	18.0	19.0	A	0.537		

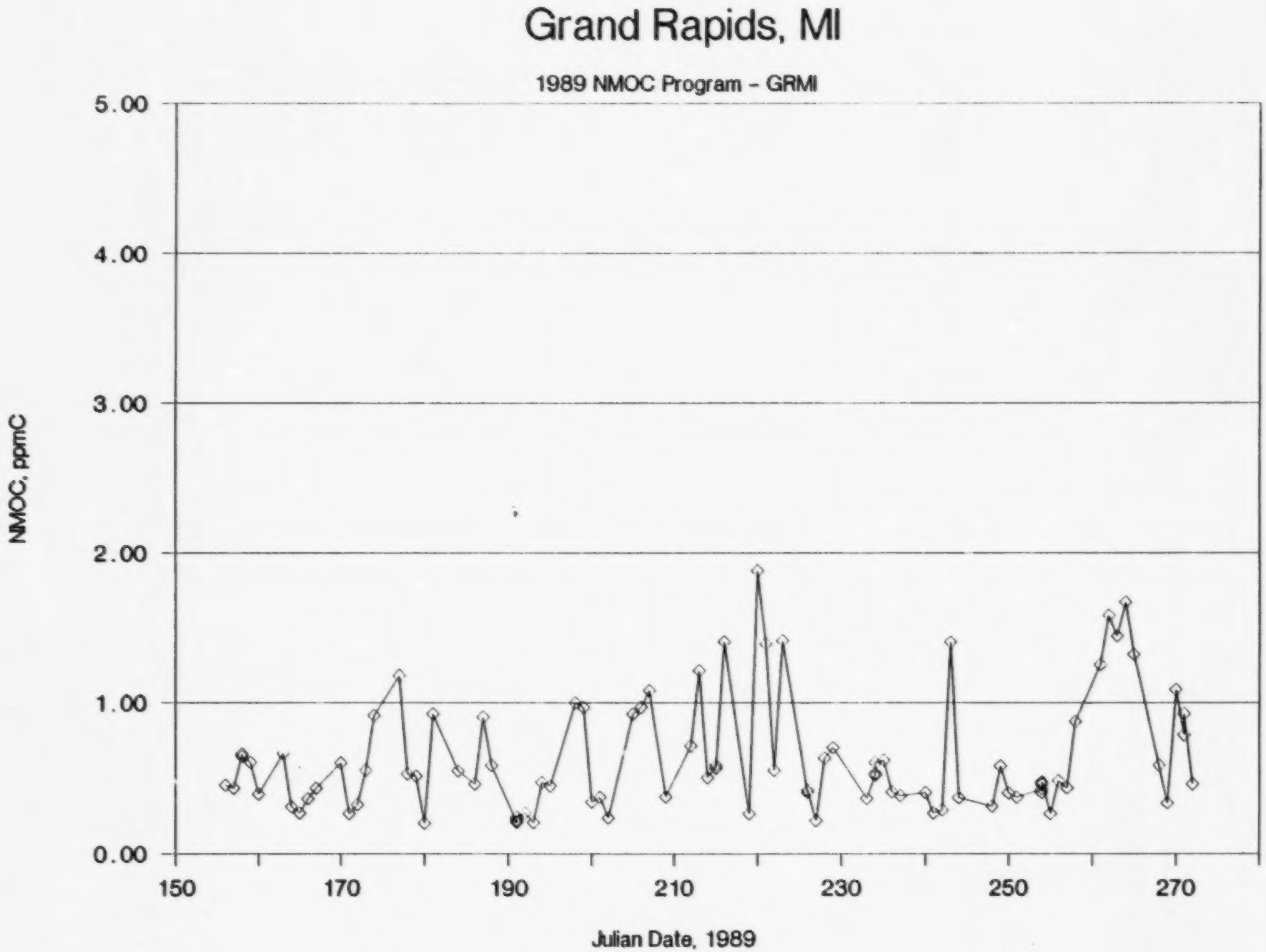

Figure C-10. Plot of NMOC concentration for Grand Rapids, MI.

TABLE C-10. SUMMARY OF THE 1989 NMOC DATA FOR GRAND RAPIDS, MI (GRMI)

Sampling Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC	QAD NMOC ppmc	AREAL NMOC ppmc
05-Jun-89	156	1015	687	11.0	10.0	D	0.456		
06-Jun-89	157	1059	75	14.0	13.0	A	0.432		
07-Jun-89	158	1068	79	18.0	18.0	C	0.661		
07-Jun-89	158	1069	813	18.0	18.0	C	0.644		
08-Jun-89	159	1081	147	14.0	14.0	B	0.607		
09-Jun-89	160	1102	894	14.0	13.0	D	0.396		
12-Jun-89	163	1141	686	15.0	14.0	B	0.666		
13-Jun-89	164	1158	791	14.0	14.0	A	0.312	0.389	
14-Jun-89	165	1202	130	14.0	13.0	D	0.271		
15-Jun-89	166	1205	728	14.0	14.0	C	0.362		
16-Jun-89	167	1215	77	18.0	16.0	D	0.432		
19-Jun-89	170	1263	656	14.0	12.0	C	0.602		
20-Jun-89	171	1285	667	14.0	14.0	D	0.265		
21-Jun-89	172	1320	812	15.0	13.0	A	0.327		
22-Jun-89	173	1330	722	15.0	15.0	B	0.554		
23-Jun-89	174	1325	109	14.0	13.0	A	0.916		
26-Jun-89	177	1392	856	14.0	14.0	D	1.181		
27-Jun-89	178	1398	686	14.0	14.0	B	0.529	0.472	
28-Jun-89	179	1435	797	15.0	15.0	A	0.513		
29-Jun-89	180	1425	631	15.0	15.0	D	0.203		
30-Jun-89	181	1462	654	15.0	15.0	D	0.924		
03-Jul-89	184	1522	872	14.0	14.0	D	0.548		
05-Jul-89	186	1544	618	15.0	15.0	D	0.460		
06-Jul-89	187	1557	895	14.0	13.0	B	0.905		
07-Jul-89	188	1582	45	14.0	12.0	D	0.585		
10-Jul-89	191	1603	640	18.0	17.0	B	0.213		
10-Jul-89	191	1604	182	18.0	18.0	C	0.243		
11-Jul-89	192	1634	93	14.0	14.0	C	0.269		
12-Jul-89	193	1658	874	14.0	14.0	D	0.206		
13-Jul-89	194	1685	12	14.0	12.0	C	0.473		
14-Jul-89	195	1720	305	14.0	14.0	C	0.449		
17-Jul-89	198	1761	711	15.0	15.0	B	1.001		
18-Jul-89	199	1776	715	15.0	14.0	B	0.966		
19-Jul-89	200	1790	783	15.0	15.0	C	0.344		
20-Jul-89	201	1825	900	14.0	14.0	A	0.375		
21-Jul-89	202	1836	79	14.0	14.0	D	0.236		
24-Jul-89	205	1881	777	15.0	15.0	C	0.925	1.008	1.017
25-Jul-89	206	1889	662	15.0	14.5	C	0.968	0.948	
26-Jul-89	207	1915	304	14.0	14.0	A	1.080	1.115	
28-Jul-89	209	1945	673	14.0	15.0	A	0.376		
31-Jul-89	212	2000	674	15.0	15.0	A	0.714		
01-Aug-89	213	2029	644	15.0	14.0	A	1.213		
02-Aug-89	214	2053	907	14.0	14.0	D	0.503		
03-Aug-89	215	2093	850	20.0	21.0	B	0.586		
03-Aug-89	215	2094	138	20.5	22.0	D	0.567		
04-Aug-89	216	2077	143	14.0	14.0	A	1.408	1.370	

TABLE C-10. SUMMARY OF THE 1989 NMOC DATA FOR GRAND RAPIDS, MI (GRMI)

Sampling Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC	QAD NMOC ppmc	AF L oC ppmc
07-Aug-89	219	2104	929	15.0	15.0	C	0.263		
08-Aug-89	220	2163	91	14.0	14.0	A	1.880		
09-Aug-89	221	2180	175	15.0	14.0	C	1.394		
10-Aug-89	222	2214	64	14.0	13.0	C	0.552		
11-Aug-89	223	2208	75	14.0	14.0	D	1.414		
14-Aug-89	226	2257	728	17.5	19.0	A	0.407		
14-Aug-89	226	2258	797	17.5	19.0	D	0.424		
15-Aug-89	227	2272	705	14.0	14.0	A	0.218		
16-Aug-89	228	2295	179	12.0	13.0	C	0.636		
17-Aug-89	229	2337	198	12.0	12.0	A	0.701		
21-Aug-89	233	2387	625	14.0	14.0	D	0.364		
22-Aug-89	234	2398	118	18.0	17.0	D	0.532		
22-Aug-89	234	2397	129	18.0	18.0	D	0.520		
23-Aug-89	235	2429	172	14.5	14.0	B	0.622		
24-Aug-89	236	2461	644	14.5	15.0	D	0.409		
25-Aug-89	237	2468	140	14.5	14.0	D	0.384		
28-Aug-89	240	2565	783	16.0	15.0	A	0.405		
29-Aug-89	241	2506	786	15.5	14.0	D	0.270		
30-Aug-89	242	[illegible]7	775	16.0	14.0	D	0.288		
31-Aug-9	243	2598	656	15.8	14.0	D	1.405		
01-Sep-89	244	2621	90	14.0	13.0	A	0.370		
05-Sep-	248	2634	150	14.5	14.0	A	0.31		
06-Se	249	2651	41	14.5	14.0	D	0.52		
07-Se	250	2679	848	14.5	14.0	C	0.40		
08-Sep-89	251	2702	3	14.2	14.0	D	0.374		
11-Sep-89	254	2707	659	20.0	19.0	A	0.462		
11-Sep-89	254	2708	784	20.0	19.0	C	0.405		
12-Sep-89	255	2777	107	14.5	15.0	D	0.263		
13-Sep-89	256	2801	62	15.0	14.0	C	0.483		
14-Sep-89	257	2819	819	15.0	15.0	C	0.436		
15-Sep-89	258	2840	98	15.0	14.0	D	0.876		
18-Sep-89	261	2873	683	16.0	14.0	D	1.253		
19-Sep-89	262	2878	842	15.0	14.0	A	1.582		
20-Sep-89	263	2905	41	14.5	14.0	A	1.445		
21-Sep-89	264	2928	838	15.0	14.0	D	1.669		
22-Sep-89	265	2967	834	14.5	14.0	D	1.319		
25-Sep-89	268	2969	883	14.5	15.0	C	0.588		
26-Sep-89	269	2997	6	14.5	14.0	D	0.337		
27-Sep-89	270	3017	126	16.0	14.0	C	1.088		
28-Sep-89	271	3046	806	21.0	19.0	C	0.927		
28-Sep-89	271	3045	797	21.0	20.0	B	0.787		
29-Sep-89	272	3061	169	15.0	15.0	D	0.462		

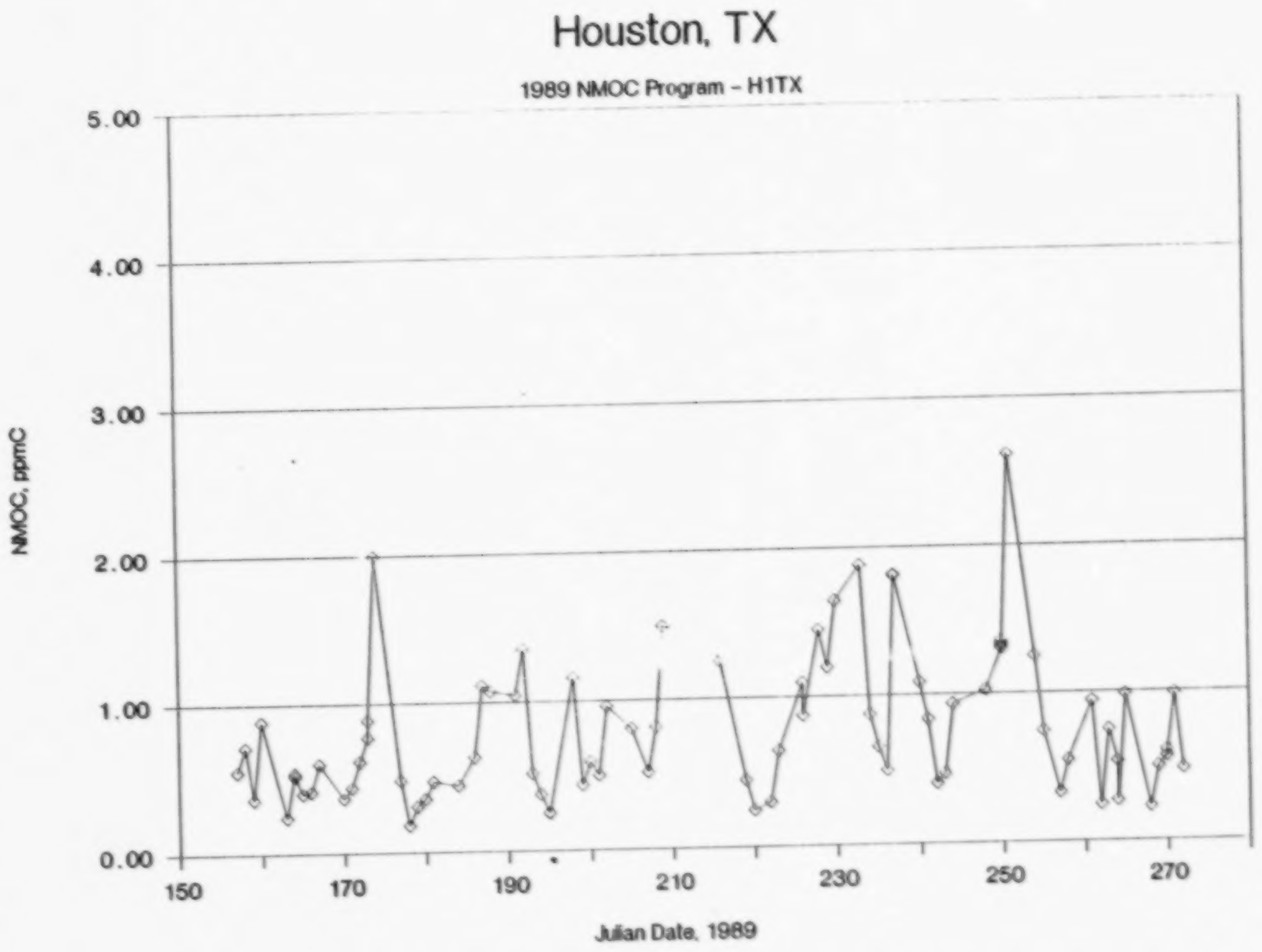

Figure C-11. Plot of NMOC concentration for Houston, TX.

TABLE C-11. SUMMARY OF THE 1989 NMOC DATA FOR HOUSTON, TX (H1TX)

Sampling Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC	QAD NMOC ppmc	AREAL NMOC ppmc
06-Jun-89	157	1025	691	11.5	10.0	D	0.550	0.566	
07-Jun-89	158	1053	635	12.0	13.0	C	0.712		
08-Jun-89	159	1103	652	13.0	13.0	A	0.363		
09-Jun-89	160	1123	658	13.0	13.0	D	0.882		
12-Jun-89	163	1151	96	12.0	12.0	B	0.241		
13-Jun-89	164	1162	46	19.0	18.0	B	0.516	0.549	
13-Jun-89	164	1161	657	19.0	18.0	A	0.538		
14-Jun-89	165	1197	796	13.0	13.0	D	0.398		
15-Jun-89	166	1222	15	12.0	10.0	D	0.413		
16-Jun-89	167	1224	786	13.0	11.0	C	0.599		
19-Jun-89	170	1260	166	12.0	10.0	D	0.365		
20-Jun-89	171	1283	870	12.0	12.0	C	0.437		
21-Jun-89	172	1317	74	12.0	12.0	D	0.612		
22-Jun-89	173	1306	643	19.0	18.0	B	0.889		
22-Jun-89	173	1305	108	19.0	20.0	B	0.769		
23-Jun-89	174	1339	780	13.0	13.0	D	1.998		
26-Jun-89	177	1389	182	12.0	12.0	A	0.482		
27-Jun-89	178	1410	927	12.0	12.0	A	0.180		
28-Jun-89	179	1429	874	12.0	12.0	B	0.307		
29-Jun-89	180	1460	697	13.0	13.0	D	0.358		
30-Jun-89	181	1501	25	13.0	13.0	C	0.473		
03-Jul-89	184	1523	825	12.0	12.0	D	0.444		
05-Jul-89	186	1539	883	12.0	10.0	D	0.631		
06-Jul-89	187	1562	161	12.0	12.0	A	1.113		
07-Jul-89	188	1580	667	13.0	11.0	B	1.074		
10-Jul-89	191	1623	104	[illegible]	12.0	A	1.044		
11-Jul-89	192	1635	807	13.0	13.0	D	1.353		
12-Jul-89	193	1636	669	13.0	13.0	D	0.518		
13-Jul-89	194	1693	86	12.0	12.0	A	0.379		
14-Jul-89	195	1728	114	19.0	19.0	C	0.254		
14-Jul-89	195	1729	650	19.0	20.0	D	0.251		
17-Jul-89	198	1736	501	12.0	12.0	D	1.156		
18-Jul-89	199	1771	691	12.0	14.0	A	0.438		
19-Jul-89	200	1770	7	12.0	12.0	C	0.594		
20-Jul-89	201	1841	658	12.0	14.0	D	0.499		
21-Jul-89	202	1831	705	12.0	13.0	A	0.961		
24-Jul-89	205	1880	628	12.0	14.0	C	0.809		
26-Jul-89	207	1917	784	12.0	14.0	A	0.514		
27-Jul-89	208	1954	150	12.0	12.0	C	0.817		
28-Jul-89	209	1944	14		12.0	B	1.495		
03-Aug-89	215	2076	72	12.0	13.0	C	1.390		
04-Aug-89	216	2079	112	12.0	11.0	A	1.248		
07-Aug-89	219	2105	172	12.0	13.0	D	0.446		
08-Aug-89	220	2152	688	19.0	20.0	D	0.264		
10-Aug-89	222	2213	161	12.0	13.0	B	0.298		
11-Aug-89	223	2218	90	12.0	13.0	C	0.640		

TABLE C-11. SUMMARY OF THE 1989 NMOC DATA FOR HOUSTON, TX (H1TX)

Sampling Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC	QAD NMOC ppmc	AREAL [illegible] ppmc
14-Aug-89	226	2246	185	12.0	12.0	D	1.093		
14-Aug-89	226	2270	814	12.0	12.0	D	0.873		
16-Aug-89	228	2300	178	12.0	12.5	C	1.449		
17-Aug-89	229	2323	920	12.0	12.0	C	1.193		
18-Aug-89	230	2332	900	12.0	12.5	D	1.643		
21-Aug-89	233	2370	68	12.0	13.0	D	1.880	1.973	1.792
22-Aug-89	234	2404	688	13.0	14.0	C	0.873		
23-Aug-89	235	2428	765	12.0	14.0	A	0.655		
24-Aug-89	236	2426	780	12.0	13.0	D	0.497		
25-Aug-89	237	2469	20	19.0	19.0	A	1.811		
25-Aug-89	237	2470	182	19.0	19.0	C	1.807		
28-Aug-89	240	2564	635		13.0	C	1.084		
29-Aug-89	241	2501	676	12.0	13.0	A	0.834	0.869	
30-Aug-89	242	2549	71	12.0	12.0	C	0.401		
31-Aug-89	243	2580	927	12.0	12.0	B	0.470		
01-Sep-89	244	2594	828	12.0	12.0	B	0.933		
05-Sep-89	248	2631	21	12.0	12.0	C	1.024		
07-Sep-89	250	2646	637	20.0	20.0	A	1.303		
07-Sep-89	250	2647	696	20.0	20.0	C	1.357		
08-Sep-89	251	2700	854	12.0	12.0	D	2.614	2.[illegible]7	
11-Sep-89	254	2752	618	12.0	14.0	B	1.247		
12-Sep-89	255	2769	45	12.0	11.0	D	1.063		
12-Sep-89	255	2749	776	12.0	12.0	C	0.741		
14-Sep-89	257	2799	783	12.0	12.0	D	0.329		
15-Sep-89	258	2835	660	12.0	12.0	A	0.545		
18-Sep-89	261	2856	625		12.0	D	0.939		
19-Sep-89	262	2899	106	12.0	12.0	B	0.244		
20-Sep-89	263	2913	43	11.0	12.0	B	0.746		
21-Sep-89	264	2936	724	19.0	20.0	A	0.532		
21-Sep-89	264	2937	854	19.0	20.0	A	0.267		
22-Sep-89	265	2959	770	12.0	13.0	B	0.982		
25-Sep-89	268	2999	407	12.0	13.0	B	0.227		
26-Sep-89	269	3010	794	12.0	12.0	A	0.497		
27-Sep-89	270	3023	645	19.0	18.0	B	0.602		
27-Sep-89	270	3022	672	19.0	19.0	B	0.562		
28-Sep-89	271	3037	683	12.0	13.0	C	0.986		
29-Sep-89	272	3076	175	12.0	12.0	C	0.481		

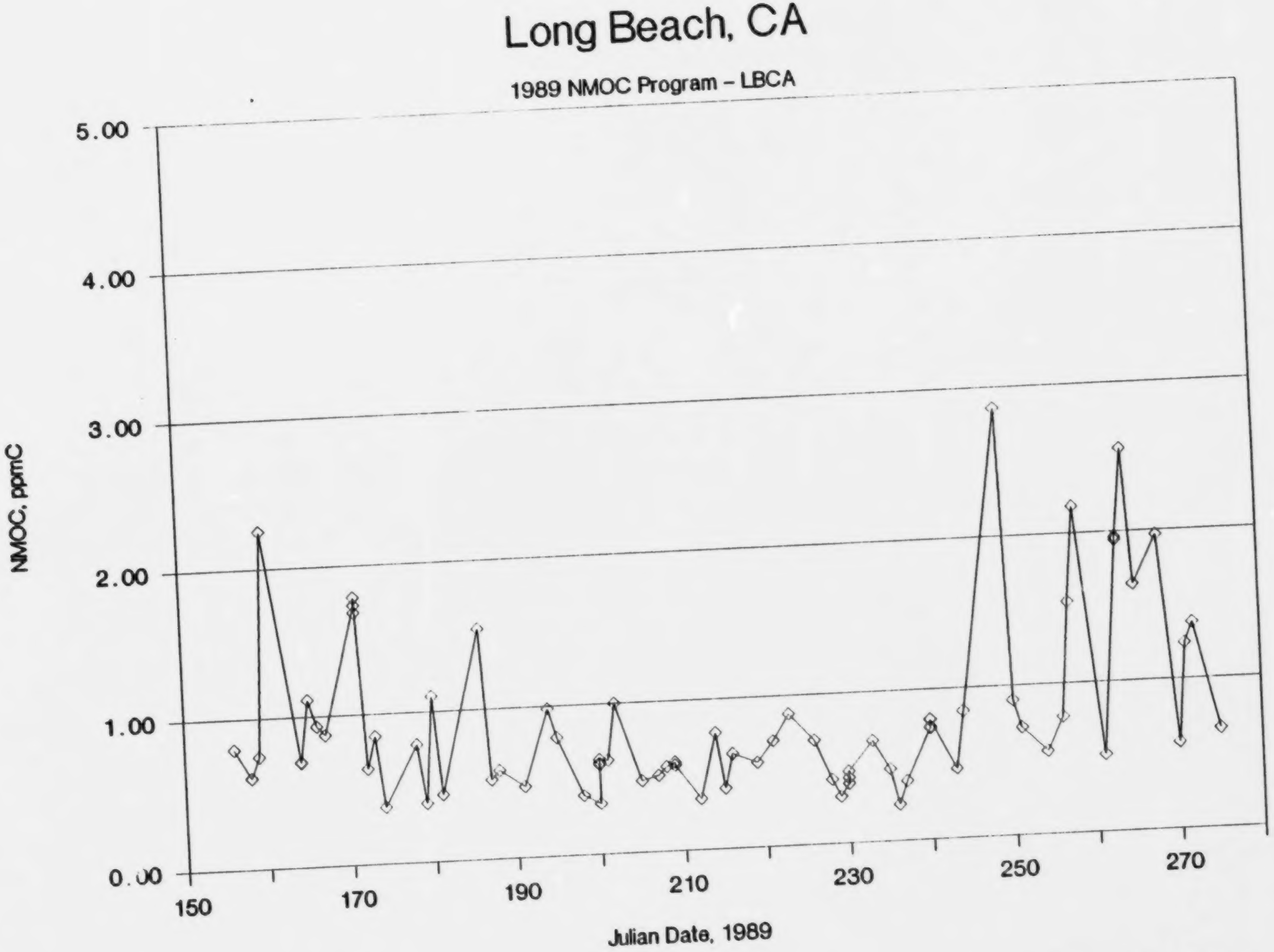

Figure C–12. Plot of NMOC concentration for Long Beach, CA.

TABLE C-12. SUMMARY OF THE 1989 NMOC DATA FOR LONG BEACH, CA (LBCA)

Sampling Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC	QAD NMOC ppmc	AREAL NMOC ppmc
05-Jun-89	156	1039	776	6.0	5.0	C	0.797		
07-Jun-89	158	1057	92	14.0	14.0	B	0.606		
08-Jun-89	159	1082	107	16.0	16.0	A	0.746		
09-Jun-89	160	1106	155	16.0	10.0	B	2.253		
13-Jun-89	164	1165	54	9.0	9.0	B	0.700		
13-Jun-89	164	1163	839	19.0	18.0	A	0.697		
14-Jun-89	165	1195	61	12.0	12.0	D	1.112		
15-Jun-89	166	1226	118	12.0	14.0	B	0.932		
16-Jun-89	167	1244	129	13.0	10.0	D	0.875		
20-Jun-89	171	1276	107	17.0	17.0	C	1.786		
20-Jun-89	171	1275	762	19.0	19.0	A	1.732		
21-Jun-89	172	1318	171	13.0	12.0	D	0.639		
22-Jun-89	173	1355	10	13.5	10.0	A	0.851	0.921	
23-Jun-89	174	1346	84	13.5	13.0	C	0.377		
27-Jun-89	178	1409	907	17.5	17.0	A	0.785		
28-Jun-89	179	1432	99	13.0	13.0	A	0.391		
29-Jun-89	180	1459	64	16.3	16.0	C	1.101		
30-Jun-89	181	1488	197	15.0	14.0	D	0.443		
05-Jul-89	186	1543	630	22.0	20.0	C	1.538		
06-Jul-89	187	1565	166	12.0	12.0	D	0.527		
07-Jul-89	188	1577	138	12.0	12.0	B	0.587		
10-Jul-89	191	1619	920	12.7	14.0	A	0.472		
13-Jul-89	194	1688	90	12.4	12.0	A	0.982		
14-Jul-89	195	1712	839	13.0	14.0	D	0.789	0.841	
17-Jul-89	198	1737	171	12.5	16.0	C	0.394		
19-Jul-89	200	1801	106	13.0	16.0	B	0.597		
19-Jul-89	200	1800	306	13.0	16.0	B	0.336		
20-Jul-89	201	1833	183	11.7	13.0	A	0.625		
21-Jul-89	202	1853	166	11.5	12.0	D	1.001		
24-Jul-89	205	1875	11	15.0	15.0	D	0.475		
26-Jul-89	207	1916	874	15.0	15.0	B	0.508		
27-Jul-89	208	1950	70	13.5	14.0	C	0.564		
28-Jul-89	209	1974	189	17.0	16.5	B	0.570		
28-Jul-89	209	1973	928	17.0	16.5	A	0.589		
31-Jul-89	212	1996	25	13.0	16.0	C	0.340		
02-Aug-89	214	2052	689	12.5	14.0	A	0.775		
03-Aug-89	215	2069	123	11.5	13.0	D	0.401		
04-Aug-89	216	2095	868	11.7	14.0	D	0.630	0.684	
07-Aug-89	219	2134	680	12.0	14.0	C	0.564		
09-Aug-89	221	2182	668	12.0	13.0	D	0.701		
11-Aug-89	223	2212	89	14.0	14.0	A	0.877		
14-Aug-89	226	2252	696	13.0	16.0	A	0.694		
16-Aug-89	228	2298	666	12.5	15.0	C	0.427		
17-Aug-89	229	2330	28	11.5	11.0	B	0.313		
18-Aug-89	230	2360	860	13.0	14.0	C	0.394		
18-Aug-89	230	2361	828	13.0	16.0	C	0.475		

TABLE C-12. SUMMARY OF THE 1989 NMOC DATA FOR LONG BEACH, CA (LBCA)

Sampling Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig	Radian Channel	Mean NMOC ppmC	QAD NMOC ppmc	AREAL NMOC ppmc
21-Aug-89	233	2382	767	15.0	16.0	C	0.670		
23-Aug-89	235	2432	165	14.0	14.0	B	0.479		
24-Aug-89	236	2460	621	13.0	12.0	B	0.242		
25-Aug-89	237	2494	854	13.0	13.0	A	0.397		
28-Aug-89	240	2483	178	18.9	17.0	D	0.747		
28-Aug-89	240	2482	157	18.9	18.0	A	0.741		
31-Aug-89	243	2595	663	12.0	14.0	D	0.464		
01-Sep-89	244	[illegible]	121	11.5	12.0	D	0.846		
06-Sep-89	249	[illegible]	155	20.0	22.0	A	2.860		
07-Sep-89	250	2703	17	11.5	13.0	D	0.903		
08-Sep-89	251	2698	180	11.5	13.0	C	0.718		
11-Sep-89	254	2753	407	12.5	13.0	D	0.554		
13-Sep-89	256	2813	37	12.0	13.0	C	0.778		
14-Sep-89	257	2820	156	11.9	12.0	D	1.541		
15-Sep-89	258	2822	900	11.5	13.0	C	2.181		
18-Sep-89	261	2868	686	12.7	15.0	A	0.514		
20-Sep-89	263	2880	702	17.0	17.0	D	1.961		
20-Sep-89	263	2879	620	17.0	18.0	D	1.945		
21-Sep-89	264	[illegible]	856	11.5	11.0	C	2.557		
22-Sep-89	265	2966	792	12.0	14.0	B	1.645		
25-Sep-89	268	2995	14	12.0	15.0	C	1.970		
27-Sep-89	270	3042	895	12.0	14.0	A	0.579		
28-Sep-89	271	3069	807	12.0	14.0	A	1.240		
29-Sep-89	272	3101	147	11.5	13.0	C	1.373		
02-Oct-89	275	3115	607	12.8	16.0	C	0.661		

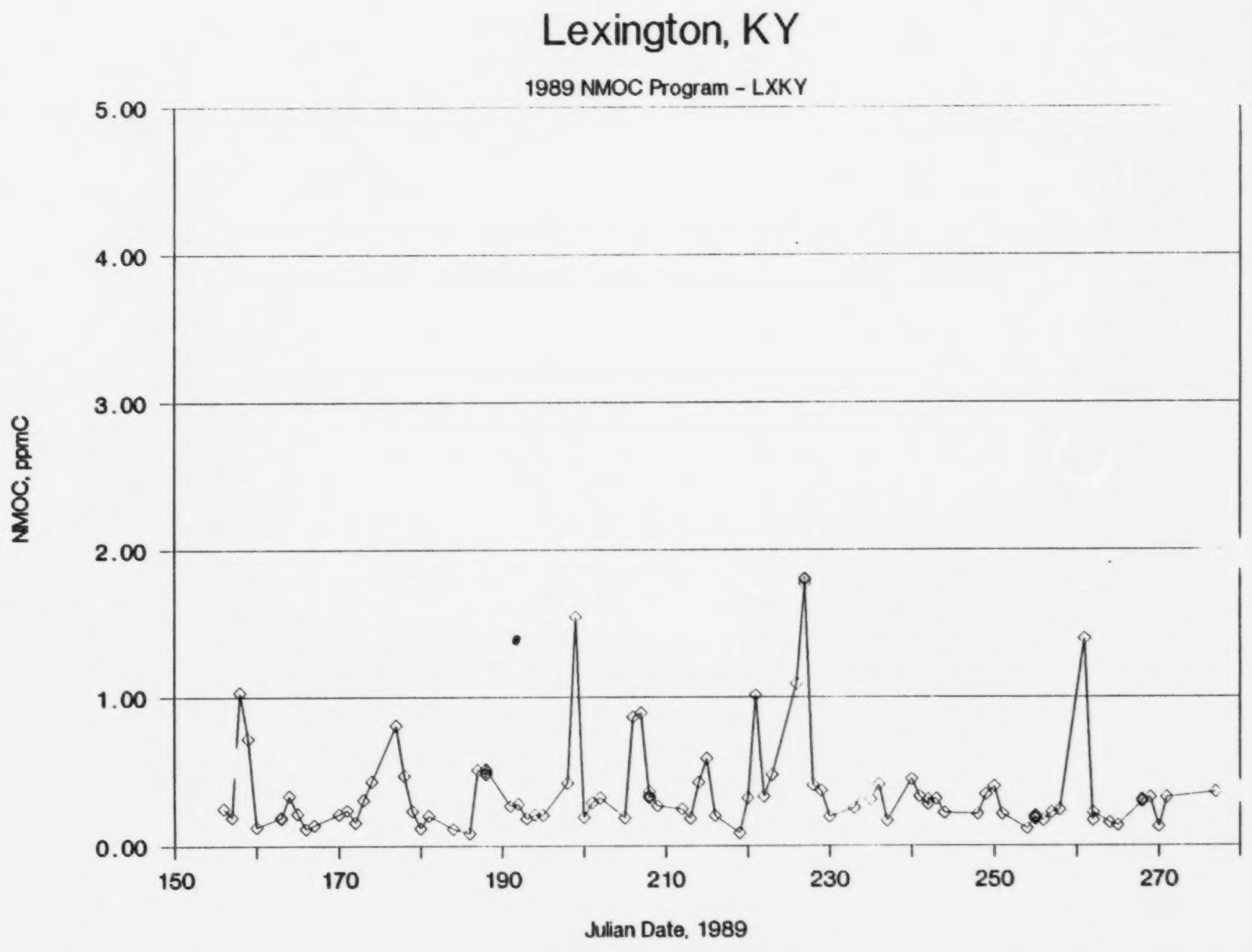

Figure C-13. Plot of NMOC concentration for Lexington, KY.

TABLE C-13. SUMMARY OF THE 1989 NMOC DATA FOR LEXINGTON, KY (LXKY)

Sampling Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC	QAD NMOC ppmc	AREAL NMOC ppmc
05-Jun-89	156	1012	15	13.0	13.0	B	0.249		
06-Jun-89	157	1075	853	13.0	13.0	D	0.192	0.240	
07-Jun-89	158	1099	622	14.0	14.0	A	1.032		
08-Jun-89	159	1156	630	15.0	14.0	A	0.723		
09-Jun-89	160	1153	100	13.0	11.0	C	0.123		
12-Jun-89	163	1144	654	18.0	19.0	A	0.184		
12-Jun-89	163	1143	677	19.0	19.0	A	0.191		
13-Jun-89	164	1167	640	14.0	13.0	D	0.335		
14-Jun-89	165	1199	179	13.0	12.5	C	0.216		
15-Jun-89	166	1210	776	14.0	14.0	B	0.113	0.165	
16-Jun-89	167	1264	165	13.0	10.0	C	0.138		
19-Jun-89	170	1262	672	14.0	11.0	A	0.213		
20-Jun-89	171	1287	136	13.0	12.0	D	0.240		
21-Jun-89	172	1322	652	13.0	13.0	C	0.157		
22-Jun-89	173	1362	51	13.0	13.5	C	0.309		
23-Jun-89	174	1393	119	13.0	12.0	C	0.432		
26-Jun-89	177	1394	687	14.0	14.0	D	0.808		
27-Jun-89	178	1466	775	14.0	13.0	D	0.473		
28-Jun-89	179	1446	169	13.0	13.0	A	0.232	0.279	
29-Jun-89	180	1484	844	13.0	13.0	D	0.119		
30-Jun-89	181	1494	662	14.0	14.0	C	0.201		
03-Jul-89	184	1524	780	14.0	12.0	A	0.113		
05-Jul-89	186	1546	301	13.0	11.0	B	0.081		
06-Jul-89	187	1591	695	14.0	12.0	D	0.512		
07-Jul-89	188	1586	10	18.0	16.0	B	0.518		
07-Jul-89	188	1585	663	18.0	16.0	B	0.502		
10-Jul-89	191	1613	813	14.0	12.0	D	0.267		
11-Jul-89	192	1641	3	13.0	12.0	B	0.281		
12-Jul-89	193	1673	98	13.0	12.0	A	0.183		
13-Jul-89	194	1684	681	14.0	12.0	D	0.207	0.253	
14-Jul-89	195	1741	188	13.0	13.0	C	0.204		
17-Jul-89	198	1775	50	13.0	13.0	B	0.425		
18-Jul-89	199	1785	793	14.0	14.0	A	1.545	1.601	
19-Jul-89	200	1792	872	13.0	12.5	D	0.192		
20-Jul-89	201	1826	404	13.0	12.0	C	0.288		
21-Jul-89	202	1848	704	14.0	14.0	A	0.322	0.335	
24-Jul-89	205	1893	778	14.0	14.0	D	0.188		
25-Jul-89	206	1919	22	13.0	12.0	B	0.866		
26-Jul-89	207	1955	32	13.0	14.0	D	0.892		
27-Jul-89	208	1956	894	18.0	17.0	A	0.362		
27-Jul-89	208	1957	41	18.0	18.0	A	0.361		
28-Jul-89	209	1981	142	13.0	12.5	C	0.270		
31-Jul-89	212	1991	38	13.0	13.0	B	0.248		
01-Aug-89	213	2033	114	13.0	12.0	D	0.185		
02-Aug-89	214	2071	621	14.0	14.0	A	0.426		
03-Aug-89	215	2073	819	13.0	13.0	D	0.587		

TABLE C-13. SUMMARY OF THE 1989 NMOC DATA FOR LEXINGTON, KY (LXKY)

Sampling Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC	QAD NMOC ppmc	AREAL NMOC ppmc
04-Aug-89	216	2107	100	13.0	12.0	D	0.203		
07-Aug-89	219	2131	98	18.0	18.0	D	0.085		
07-Aug-89	219	2130	687	18.0	18.0	C	0.088		
08-Aug-89	220	2165	97	13.0	12.0	D	0.320		
09-Aug-89	221	2184	501	13.0	12.5	D	1.010		
10-Aug-89	222	2203	671	14.0	14.0	D	0.331		
11-Aug-89	223	2235	25	13.0	13.0	C	0.477		
14-Aug-89	226	2244	637	14.0	14.0	C	1.091		
15-Aug-89	227	2313	10	18.0	18.0	B	1.796		
15-Aug-89	227	2312	301	18.0	18.0	B	1.771		
16-Aug-89	228	2306	642	14.0	14.0	D	0.409		
17-Aug-89	229	2326	66	13.5	12.5	C	0.372		
18-Aug-89	230	2352	60	13.0	12.5	D	0.195	0.217	
21-Aug-89	233	2384	631	14.0	13.0	D	0.256		
22-Aug-89	234	2427	166	13.0	13.0	D	0.369		
23-Aug-89	235	2467	407	13.0	13.0	D	0.312		
24-Aug-89	236	2478	18	13.0	12.0	C	0.413		
25-Aug-89	237	2474	96	13.0	12.0	C	0.166		
28-Aug-89	240	2567	642	14.0	14.0	C	0.449		
29-Aug-89	241	2510	84	13.0	13.0	C	0.332		
30-Aug-89	242	2533	175	18.0	18.0	C	0.279		
30-Aug-89	242	2534	722	18.0	18.0	B	0.308		
31-Aug-89	243	2576	620	14.0	14.0	A	0.315		
01-Sep-89	244	2641	669	13.0	13.0	C	0.220		
05-Sep-89	248	2632	172	14.0	13.0	B	0.213	0.659	
06-Sep-89	249	2717	870	13.0	13.0	C	0.346		
07-Sep-89	250	2720	823	13.0	13.0	A	0.399		
08-Sep-89	251	2724	677	14.0	14.0	B	0.213		
11-Sep-89	254	2770	724	14.0	13.0	D	0.111		
12-Sep-89	255	2784	186	18.0	18.0	D	0.184		
12-Sep-89	255	2783	778	18.0	18.0	A	0.194		
13-Sep-89	256	2806	147	13.0	12.0	D	0.169		
14-Sep-89	257	2829	68	12.0	12.0	B	0.222		
15-Sep-89	258	2842	726	14.0	14.0	B	0.242		
18-Sep-89	261	2857	109	17.0	11.0	A	1.397		
19-Sep-89	262	2915	695	14.0	14.0	C	0.170		
20-Sep-89	262	2916	115	13.0	14.0	D	0.221		
21-Sep-89	264	2962	64	13.0	13.0	B	0.152		
22-Sep-89	265	2963	303	13.0	13.0	A	0.134		
25-Sep-89	268	2978	675	18.0	18.0	D	0.308		
25-Sep-89	268	2977	129	18.0	19.0	C	0.298		
26-Sep-89	269	3009	32	13.0	12.0	C	0.325		
27-Sep-89	270	3029	625	14.0	14.0	B	0.126		
28-Sep-89	271	3062	715	14.0	15.0	A	0.322		
29-Sep-89	277	3094	899	13.0	14.0	C	0.359		

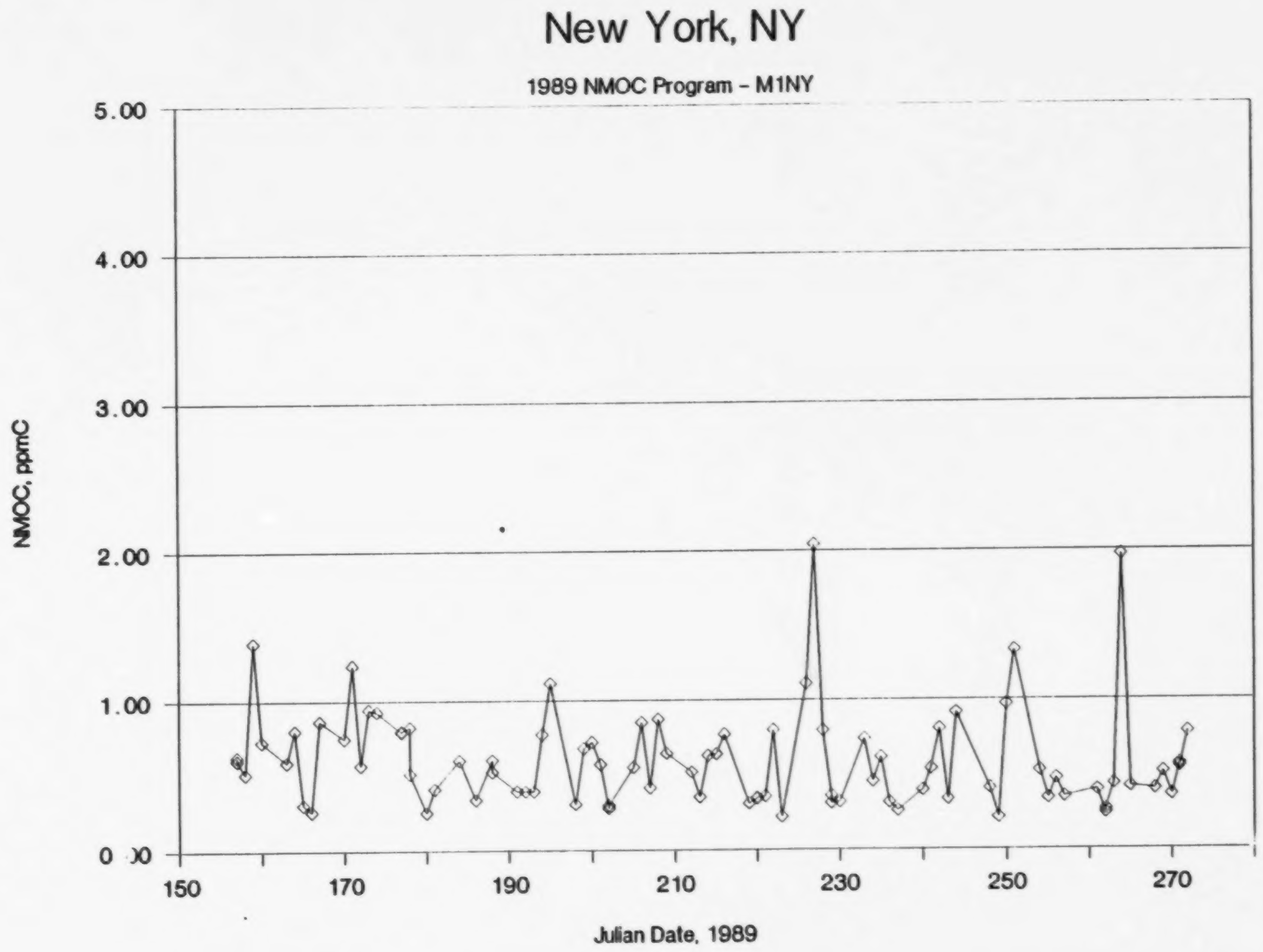

Figure C-14. Plot of NMOC concentration for New York, NY (P. S. 59).

TABLE C-14. SUMMARY OF THE 1989 NMOC DATA FOR NEW YORK, NY (M1NY)

Sampling Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC	QAD NMOC ppmc	AREAL NMOC ppmc
06-Jun-89	157	1045	812	23.0	22.0	B	0.630		
06-Jun-89	157	1046	921	23.0	22.0	D	0.608		
07-Jun-89	158	1065	165	13.0	13.0	B	0.515		
08-Jun-89	159	1090	810	14.0	14.0	D	1.387		
09-Jun-89	160	1119	794	14.0	14.5	B	0.727		
12-Jun-89	163	1139	304	14.0	14.0	C	0.594		
13-Jun-89	164	1166	927	16.0	14.0	B	0.803		
14-Jun-89	165	1186	36	14.0	13.0	C	0.307		
15-Jun-89	166	1213	920	14.0	14.0	D	0.262		
16-Jun-89	167	1235	720	14.0	12.0	C	0.864		
19-Jun-89	170	1251	875	14.0	12.0	D	0.751	0.785	
20-Jun-89	171	1282	925	14.0	15.0	D	1.235		
21-Jun-89	172	1316	72	14.0	13.0	C	0.570		
22-Jun-89	173	1337	883	14.0	14.0	D	0.944		
23-Jun-89	174	1360	789	14.0	14.0	A	0.928		
26-Jun-89	177	1378	404	26.0	26.0	B	0.791		
26-Jun-89	177	1379	621	26.0	26.0	C	0.799		
27-Jun-89	178	1405	788	14.0	14.0	A	0.822		
28-Jun-89	179	1420	406	14.0	13.0	B	0.515	0.567	
29-Jun-89	180	1445	31	14.0	14.0	C	0.255		
30-Jun-89	181	1487	306	14.0	14.0	A	0.414		
03-Jul-89	184	1509	303	14.0	14.0	D	0.601	0.670	
05-Jul-89	186	1528	72	14.0	14.0	C	0.339	0.403	
07-Jul-89	188	1589	53	25.0	24.0	B	0.603		
07-Jul-89	188	1590	688	25.0	24.0	A	0.526		
10-Jul-89	191	1612	774	14.5	16.0	D	0.397		
11-Jul-89	192	1629	687	18.0	16.0	B	0.394		
12-Jul-89	193	1678	35	17.0	17.0	A	0.392		
13-Jul-89	194	1695	784	17.5	17.0	B	0.775		
14-Jul-89	195	1722	623	17.5	18.0	B	1.114		
17-Jul-89	198	1758	146	17.0	18.0	A	0.309		
18-Jul-89	199	1752	870	17.0	18.0	C	0.681		
19-Jul-89	200	1799	895	16.5	17.0	B	0.721		
20-Jul-89	201	1835	112	17.0	17.0	C	0.573		
21-Jul-89	202	1862	92	24.0	24.0	B	0.282		
21-Jul-89	202	1863	807	24.0	24.0	D	0.301		
24-Jul-89	205	1872	33	14.0	15.0	C	0.554		
25-Jul-89	206	1904	921	14.0	14.0	C	0.850		
26-Jul-89	207	1938	765	14.5	14.0	A	0.417		
27-Jul-89	208	1960	770	14.5	15.0	D	0.873		
28-Jul-89	209	1976	695	14.0	14.0	C	0.645		
31-Jul-89	212	2011	8	14.0	14.0	C	0.520		
01-Aug-89	213	2013	678	14.0	14.0	B	0.353		
02-Aug-89	214	2055	637	14.0	15.0	D	0.630		
03-Aug-89	215	2081	807		15.0	B	0.640		
04-Aug-89	216	2110	404	14.0	14.0	B	0.773		

TABLE C-14. SUMMARY OF THE 1989 NMOC DATA FOR NEW YORK, NY (M1NY)

Sampling Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC	QAD NMOC ppmc	AREAL NMOC ppmc
07-Aug-89	219	2126	6	14.0	13.0	C	0.308		
08-Aug-89	220	2157	766	27.0	27.0	D	0.345		
08-Aug-89	220	2156	848	27.0	27.0	D	0.342		
09-Aug-89	221	2175	19	17.0	17.0	C	0.356		
10-Aug-89	222	2196	181	17.0	17.0	C	0.799		
11-Aug-89	223	2236	137	16.5	17.0	C	0.220		
14-Aug-89	226	2254	686	18.0	18.0	A	1.107		
15-Aug-89	227	2287	52	16.0	17.0	A	2.043		
16-Aug-89	228	2301	135	16.0	17.0	D	0.795		
17-Aug-89	229	2348	692	28.0	28.0	B	0.359		
17-Aug-89	229	2349	670	28.0	28.0	D	0.312		
18-Aug-89	230	2363	651	15.0	14.0	A	0.318		
21-Aug-89	233	2377	834	14.0	13.0	C	0.739		
22-Aug-89	234	2411	197	14.0	14.0	A	0.456		
23-Aug-89	235	2442	93	14.0	14.0	D	0.614		
24-Aug-89	236	2450	659	14.0	15.0	C	0.315	0.333	
25-Aug-89	237	2488	646	14.5	15.0	C	0.258		
28-Aug-89	240	2528	848	14.0	14.0	B	0.396		
29-Aug-89	241	2522	668	14.0	15.0	D	0.538		
30-Aug-89	242	2553	66	14.0	14.0	D	0.807		
31-Aug-89	243	2603	113	27.0	28.0	B	0.335		
31-Aug-89	243	2604	45	27.0	29.0	D	0.334		
01-Sep-89	244	2626	91	14.0	14.0	A	0.912		
05-Sep-89	248	2620	70	14.0	14.0	B	0.406		
06-Sep-89	249	2659	25	14.0	14.0	B	0.211		
07-Sep-89	250	2697	305	14.0	15.0	D	0.967		
08-Sep-89	251	2723	634	14.5	15.0	B	1.329		
11-Sep-89	254	2740	689	14.0	14.0	D	0.524		
12-Sep-89	255	2771	777	12.0	13.0	C	0.339		
13-Sep-89	256	2782	112	14.0	14.0	C	0.471		
14-Sep-89	257	2810	860	13.0	13.0	B	0.349		
18-Sep-89	261	2869	825	14.0	14.0	B	0.392		
19-Sep-89	262	2882	171	28.0	28.0	D	0.263		
19-Sep-89	262	2881	305	28.0	28.0	C	0.241		
20-Sep-89	263	2912	624	18.0	19.0	B	0.434		
21-Sep-89	264	2931	707	18.0	18.0	D	1.968		
22-Sep-89	265	2957	632	16.0	16.0	D	0.416		
25-Sep-89	268	2988	75	18.0	18.0	D	0.398		
26-Sep-89	269	3012	96	16.0	16.0	C	0.513		
27-Sep-89	270	3039	72	17.5	18.0	C	0.360		
28-Sep-89	271	3055	669	27.0	28.0	C	[illegible]		
28-Sep-89	271	3054	842	27.0	28.0	D	0.568		
29-Sep-89	272	3103	924	14.0	14.0	A	0.780		

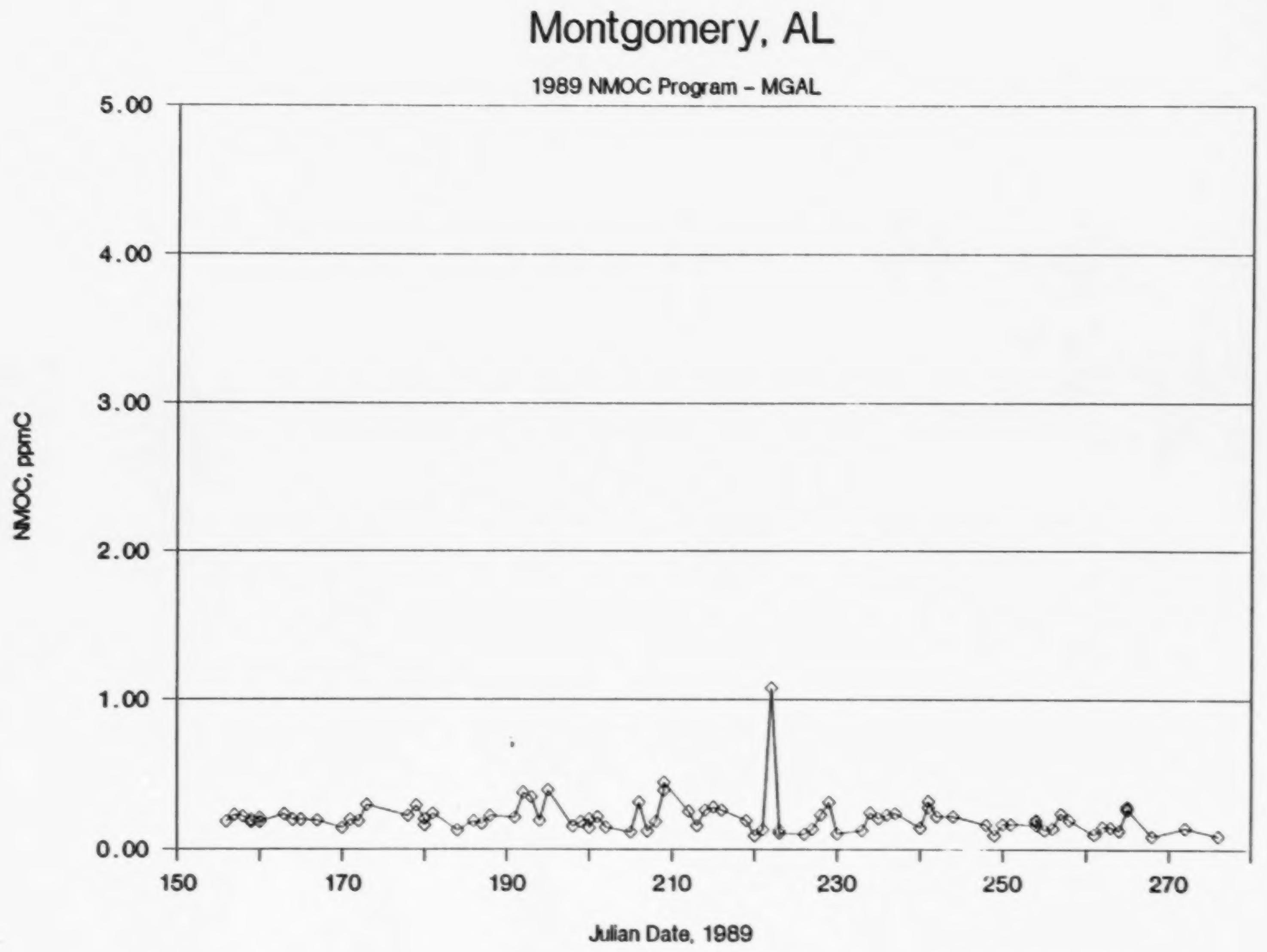

Figure C-15. Plot of NMOC concentration for Montgomery, AL.

TABLE C-15. SUMMARY OF THE 1989 NMOC DATA FOR MONTGOMERY, AL (MGAL)

Sampling Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC	QAD NMOC ppmc	AREAL NMOC ppmc
05-Jun-89	156	1014	406	14.0	14.0	A	0.186		
06-Jun-89	157	1032	856	14.0	12.0	A	0.231		
07-Jun-89	158	1063	777	14.5	14.0	A	0.220		
08-Jun-89	159	1128	807	14.5	14.0	C	0.181		
09-Jun-89	160	1114	621	14.5	14.0	D	0.184		
09-Jun-89	160	1113	641	14.5	14.0	D	0.207		
12-Jun-89	163	1164	629	14.5	14.0	B	0.232		
13-Jun-89	164	1171	848	14.0	13.0	C	0.197		
14-Jun-89	165	1219	659	14.4	10.0	C	0.198		
16-Jun-89	167	1225	773	14.3	10.0	B	0.190		
19-Jun-89	170	1300	638	18.0	15.5	A	0.144		
20-Jun-89	171	1314	138	14.0	12.0	A	0.197		
21-Jun-89	172	1313	808	14.2	13.0	D	0.189		
22-Jun-89	173	1342	400	14.1	12.0	A	0.299		
27-Jun-89	178	1468	670	13.9	12.0	C	0.221		
28-Jun-89	179	1443	680	14.1	12.0	B	0.292		
29-Jun-89	180	1454	791	13.9	13.0	C	0.201		
29-Jun-89	180	1455	814	14.0	13.0	D	0.159		
30-Jun-89	181	1520	786	14.1	16.0	C	0.238		
03-Jul-89	184	1526	131	15.5	12.0	B	0.124		
05-Jul-89	186	1527	96	16.9	14.0	D	0.187	0.240	
06-Jul-89	187	1576	70	16.0	13.0	D	0.170		
07-Jul-89	188	1622	28	16.0	15.0	C	0.222		
10-Jul-89	191	1642	705	16.2	15.0	A	0.210		
11-Jul-89	192	1671	99	16.0	14.0	B	0.378		
12-Jul-89	193	1683	62	16.0	13.0	C	0.349	0.405	
13-Jul-89	194	1690	302	15.9	12.0	D	0.191		
14-Jul-89	195	1764	121	16.0	12.5	B	0.395	0.453	
17-Jul-89	198	1773	634	16.1	16.0	D	0.153		
18-Jul-89	199	1763	301	15.9	15.0	D	0.186	0.225	
19-Jul-89	200	1808	36	12.6	12.0	B	0.203		
19-Jul-89	200	1809	857	12.6	12.0	B	0.144		
20-Jul-89	201	1832	663	16.0	15.0	D	0.216		
21-Jul-89	202	1849	640	16.2	16.0	D	0.146	0.154	
24-Jul-89	205	1883	868	16.0	16.0	D	0.113		
25-Jul-89	206	1924	57	16.1	16.0	C	0.316		
26-Jul-89	207	1914	796	16.0	16.0	C	0.122		
27-Jul-89	208	1952	645	16.2	14.0	A	0.184		
28-Jul-89	209	2022	176	14.0	13.0	C	0.446		
28-Jul-89	209	2021	726	14.0	13.0	D	0.397		
31-Jul-89	212	2023	131	16.2	16.0	D	0.252		
01-Aug-89	213	2068	808	16.7	16.0	D	0.158	0.214	
02-Aug-89	214	2066	28	16.3	16.0	B	0.260		
03-Aug-89	215	2106	767	16.5	16.0	B	0.280		
04-Aug-89	216	2102	774	16.3	16.0	A	0.262		
07-Aug-89	219	2135	102	16.1	15.0	D	0.190		

TABLE C-15. SUMMARY OF THE 1989 NMOC DATA FOR MONTGOMERY, AL (MGAL)

Sampling Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC	QAD NMOC ppmc	AREAL NMOC ppmc
08-Aug-89	220	2172	663	16.0	16.0	C	0.089	0.135	
09-Aug-89	221	2205	646	16.4	16.0	D	0.133		
10-Aug-89	222	2221	806	17.3	16.0	D	1.075		
11-Aug-89	223	2228	726	14.0	12.0	C	0.106		
11-Aug-89	223	2227	660	14.0	14.0	A	0.130		
14-Aug-89	226	2271	689	16.3	15.0	B	0.100		
15-Aug-89	227	2275	667	16.8	16.0	C	0.134		
16-Aug-89	228	2304	783	16.3	15.0	D	0.231		
17-Aug-89	229	2334	645	16.4	15.0	A	0.315		
18-Aug-89	230	2354	871	16.1	15.0	B	0.104		
21-Aug-89	233	2408	33	16.0	15.0	B	0.124		
22-Aug-89	234	2403	305	16.0	15.0	D	0.243		
23-Aug-89	235	2471	63	14.0	14.0	C	0.206		
24-Aug-89	236	2462	637	16.8	15.0	C	0.230		
25-Aug-89	237	2570	131	15.9	15.0	B	0.240		
28-Aug-89	240	502	27	16.0	14.5	C	0.142	0.178	
29-Aug-89	241	523	61	13.1	13.0	B	79		
29-Aug-89	241	2524	3	13.3	13.0	A	0.321		
30-Aug-89	242	2579	767	16.1	15.0	D	0.220		
31-Aug-89	243	2600	857	16.1	14.0	D	0.219	0.247	
01-Sep-89	244	2704	164	16.3	16.0	B	1.133		
05-Sep-89	248	2726	868	16.3	16.0	B	0.164		
06-Sep-89	249	2719	33	16.0	15.0	D	0.093		
07-Sep-89	250	2713	807	16.0	15.0	D	0.166		
08-Sep-89	251	2716	36	16.9	14.0	C	0.167		
11-Sep-89	254	2736	131	13.2	8.0	C	0.185		
11-Sep-89	254	2737	18	13.3	11.0	D	0.195		
12-Sep-89	255	2786	656	15.2	14.0	C	0.126		
13-Sep-89	256	2846	126	14.5	14.0	C	0.138		
14-Sep-89	257	2815	828	14.5	15.0	B	0.238		
15-Sep-89	258	2811	183	15.0	13.0	A	0.193		
18-Sep-89	261	2896	192	15.0	14.0	A	0.098		
19-Sep-89	262	2914	661	15.5	15.0	C	0.149		
20-Sep-89	263	2934	93	13.9	13.0	C	0.147		
21-Sep-89	264	2932	916	13.5	13.0	D	0.124		
22-Sep-89	265	2953	138	13.5	12.0	B	0.268		
22-Sep-89	265	2954	157	13.5	12.0	C	0.271		
25-Sep-89	268	2996	186	15.6	14.0	C	0.087		
28-Sep-89	276	3091	921	15.0	15.0	A	0.091		
29-Sep-89	272	3104	21	15.0	14.0	C	0.143		

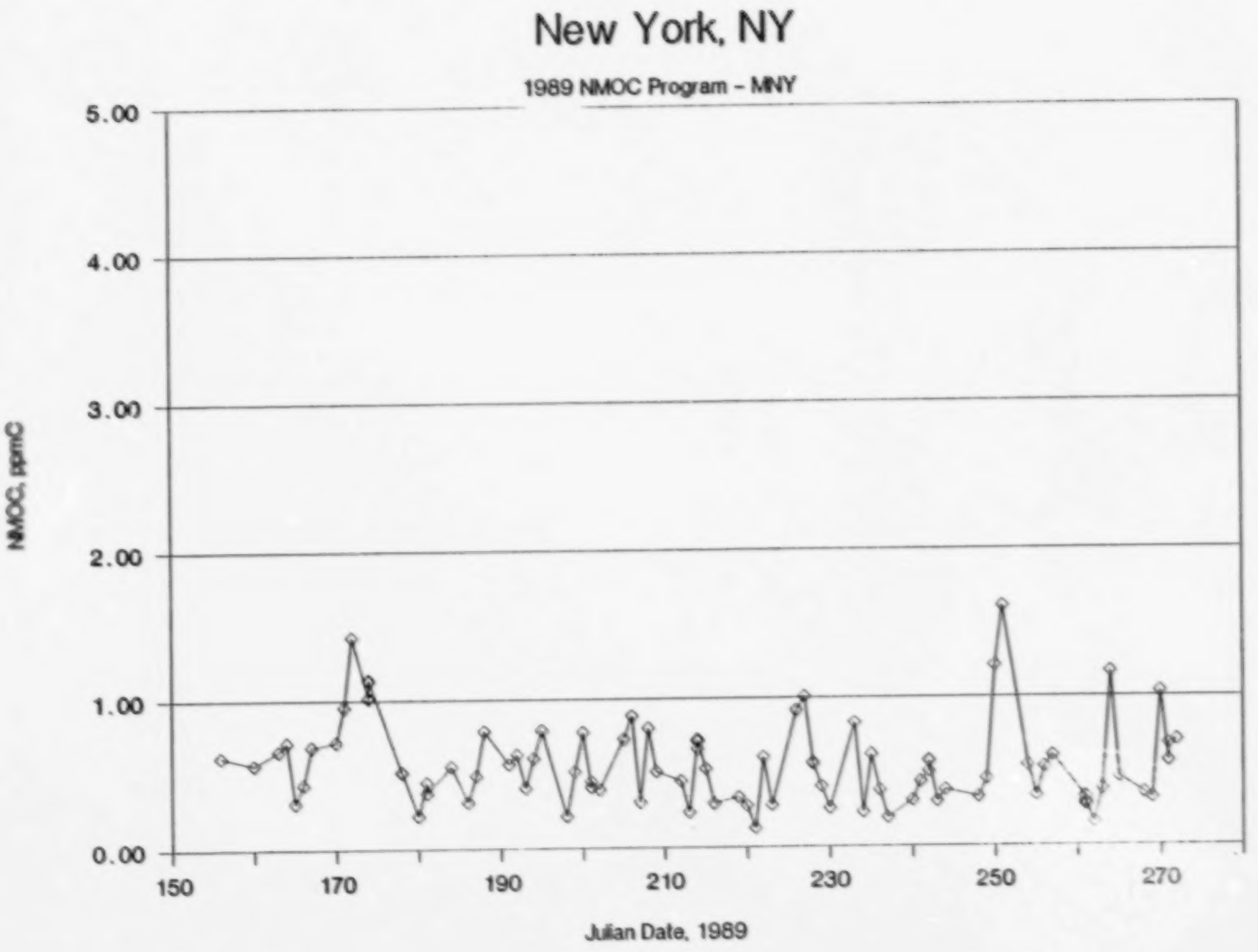

Figure C-16. Plot of NMOC concentration for New York, NY (Mabel Dean).

TABLE C-16. SUMMARY OF THE 1989 NMOC DATA FOR NEW YORK, NY (MNY)

Sampling Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC	GAD NMOC ppmc	AREAL NMOC ppmc
05-Jun-89	156	1018	172	19.5	18.0	B	0.618		
05-Jun-89	156	1019	45	19.5	19.0	C	0.620		
09-Jun-89	160	1112	84	16.0	15.0	C	0.568		
12-Jun-89	163	1140	856	16.0	16.0	D	0.658		
13-Jun-89	164	1168	106	15.0	15.0	C	0.716		
14-Jun-89	165	1185	687	16.5	16.5	B	0.312		
15-Jun-89	166	1214	169	16.0	16.0	C	0.436		
16-Jun-89	167	1236	635	16.0	14.0	D	0.687	0.718	
19-Jun-89	170	1250	89	16.0	13.0	C	0.718	0.736	
20-Jun-89	171	1281	807	17.0	16.0	D	0.951		
21-Jun-89	172	1312	161	16.0	16.0	B	1.424		
23-Jun-89	174	1357	100	18.0	18.0	B	1.010		
23-Jun-89	174	1358	823	18.0	18.0	C	1.140		
27-Jun-89	178	1406	150	16.0	14.0	D	0.514		
28-Jun-89	179	1419	828	16.0	15.0	A	0.518	0.476	
29-Jun-89	180	1448	776	17.0	16.0	D	0.222		
30-Jun-89	181	1497	188	20.0	17.0	A	0.447		
30-Jun-89	181	1498	15	20.0	18.0	A	0.378		
03-Jul-89	184	1508	660	16.0	16.0	D	0.553		
05-Jul-89	186	1548	870	14.0	14.0	C	0.316		
06-Jul-89	187	1551	834	14.0	12.0	C	0.492		
07-Jul-89	188	1581	646	15.0	12.0	A	0.739		
10-Jul-89	191	1611	97	14.0	14.0	A	0.568		
11-Jul-89	192	1630	907	14.5	14.0	B	0.628		
12-Jul-89	193	1679	864	14.5	14.0	B	0.407		
13-Jul-89	194	1694	698	16.0	16.0	A	0.606		
14-Jul-89	195	1723	677	16.0	16.0	D	0.793		
17-Jul-89	198	1757	87	14.0	14.0	D	0.216		
18-Jul-89	199	1753	883	14.0	14.0	D	0.515		
19-Jul-89	200	1798	722	15.0	16.0	D	0.778		
20-Jul-89	201	1821	147	18.0	18.0	B	0.409		
20-Jul-89	201	1822	834	18.0	18.0	D	0.447		
21-Jul-89	202	1828	767	16.0	16.0	D	0.393		
24-Jul-89	205	1885	37	15.5	16.0	A	0.730		
25-Jul-89	206	1903	182	16.0	16.0	B	0.886		
26-Jul-89	207	1937	814	16.0	16.0	B	0.306		
27-Jul-89	208	1961	878	16.0	15.0	C	0.803		
28-Jul-89	209	1975	1	15.0	15.0	D	0.511		
31-Jul-89	212	2010	860	16.0	16.0	D	0.448		
01-Aug-89	213	2012	184	15.0	15.0	C	0.236	0.332	
02-Aug-89	214	2062	10	18.0	18.0	B	0.710		
03-Aug-89	215	2083	853	24.0	24.0	B	0.529		
04-Aug-89	216	2109	409	15.0	14.0	B	0.295		
07-Aug-89	219	2127	147	14.0	14.0	A	0.333		
08-Aug-89	220	2159	182	16.0	14.0	C	0.279		
09-Aug-89	221	2176	171	15.0	14.0	B	0.127		

TABLE C-16. SUMMARY OF THE 1989 NMOC DATA FOR NEW YORK, NY (MNY)

Sampling Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC	QAD NMOC ppmc	AREAL NMOC ppmc
10-Aug-89	222	2197	3	15.0	15.0	D	0.603		
11-Aug-89	223	2230	681	16.0	14.0	C	0.281		
14-Aug-89	226	2253	718	16.0	15.0	D	0.912		
15-Aug-89	227	2286	186	14.0	14.0	D	1.006		
16-Aug-89	228	2285	112	17.0	15.0	C	0.556		
16-Aug-89	228	2284	151	17.0	17.0	B	0.566		
17-Aug-89	229	2358	813	15.0	15.0	D	0.405		
18-Aug-89	230	2362	92	14.0	14.0	D	0.259		
21-Aug-89	233	2376	91	14.0	13.0	B	0.828		
22-Aug-89	234	2412	41	14.0	13.0	B	0.230		
23-Aug-89	235	2441	105	13.5	12.0	C	0.617		
24-Aug-89	236	2451	30	13.0	12.5	B	0.376		
25-Aug-89	237	2489	677	14.0	14.0	D	0.192		
28-Aug-89	240	2559	689	14.0	14.0	C	0.305		
29-Aug-89	241	2521	31	13.0	12.0	C	0.433		
30-Aug-89	242	2532	181	15.0	12.5	C	0.571		
30-Aug-89	242	2531	794	15.0	14.0	B	0.501		
31-Aug-89	243	2593	860	14.0	13.0	D	0.301		
01-Sep-89	244	2625	645	14.0	[illegible]	B	0.377		
05-Sep-89	248	2619	814	14.0		D	0.328		
06-Sep-89	249	2666	105	14.0		D	0.453		
07-Sep-89	250	2696	50	14.0	13.0	C	1.210		
08-Sep-89	251	2725	635	14.0	14.0	D	1.609		
11-Sep-89	254	2741	687	14.0	12.0	C	0.538		
12-Sep-89	255	2775	722	14.0	13.0	C	0.336		
13-Sep-89	256	2785	188	13.0	12.0	C	0.528		
14-Sep-89	257	2809	875	13.0	12.0	D	0.605		
18-Sep-89	261	2864	649	16.0	14.5	C	0.273		
18-Sep-89	261	2863	715	16.0	14.5	C	0.322		
19-Sep-89	262	2895	100	12.0	12.0	B	0.154		
20-Sep-89	263	2911	180	12.0	12.0	C	0.378		
21-Sep-89	264	2929	718	12.0	12.0	C	1.164		
22-Sep-89	265	2976	772	13.0	13.0	A	0.458		
25-Sep-89	268	2987	31	13.0	12.0	A	0.355		
26-Sep-89	269	3013	16	12.0	11.0	C	0.318		
27-Sep-89	270	[illegible]32	143	14.0	12.0	C	1.032		
28-Sep-89	271	[illegible]53	155	16.0	16.0	C	0.680		
28-Sep-89	271	3052	825	16.0	16.0	B	0.565		
29-Sep-89	272	3102	43	12.0	12.0	D	0.706		

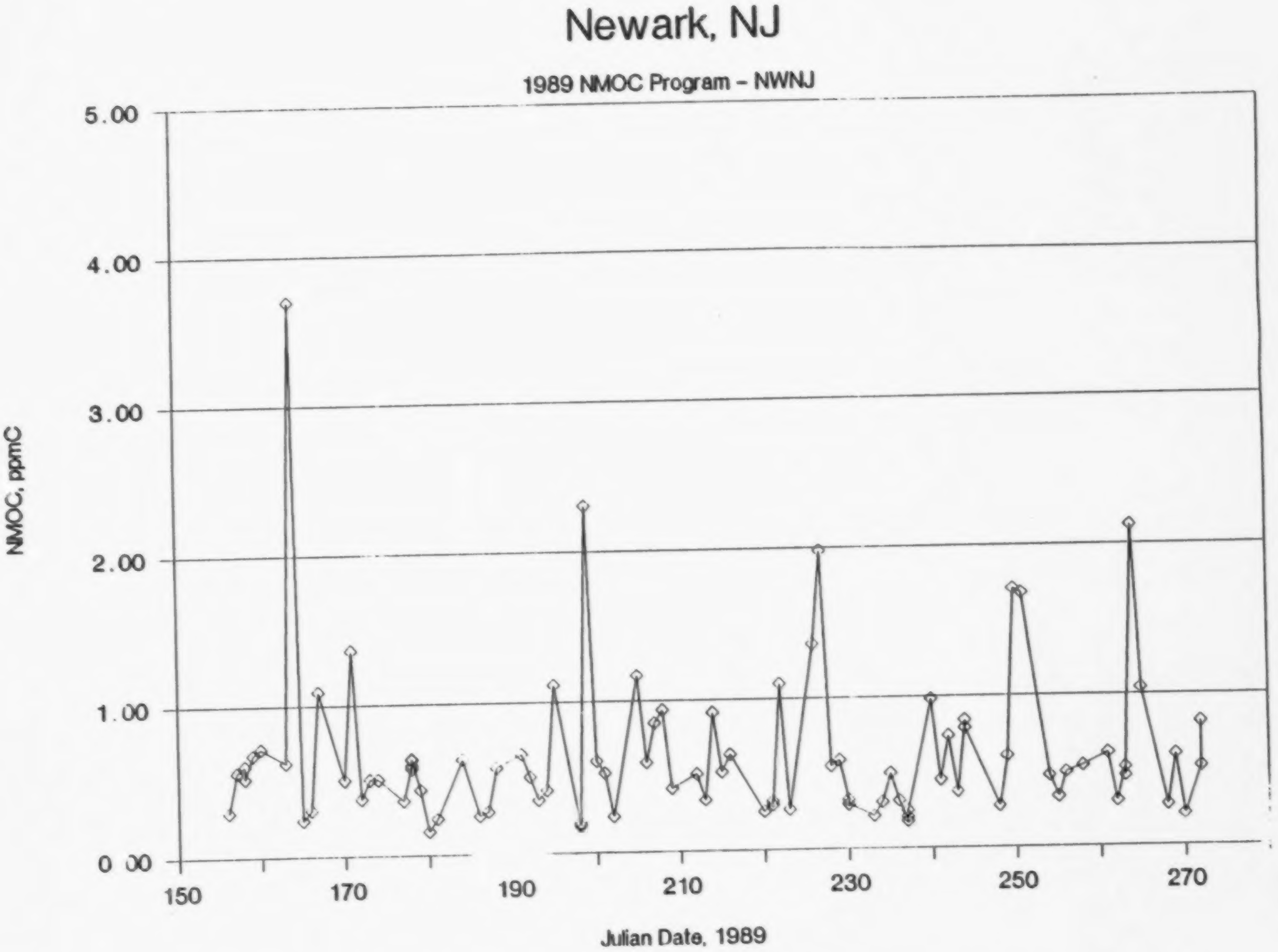

Figure C-17. Plot of NMOC concentration for Newark, NJ.

TABLE C-17. SUMMARY OF THE 1989 NMOC DATA FOR NEWARK, NJ (NWNJ)

Sampling Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC	QAD NMOC ppmc	AREAL NMOC ppmc
05-Jun-89	156	1034	162	15.4	14.0	B	0.297		
06-Jun-89	157	1054	689	15.6	15.0	B	0.562		
07-Jun-89	158	1078	1	6.5	6.0	C	0.607		
07-Jun-89	158	1079	831	17.2	16.0	C	0.521		
08-Jun-89	159	1096	823	14.5	14.0	A	0.678		
09-Jun-89	160	1137	400	15.0	15.0	C	0.720		
12-Jun-89	163	1138	62	15.2	15.0	B	0.624		
13-Jun-89	164	1188	164	18.4	18.0	B	3.699		
14-Jun-89	165	1189	7	15.0	14.0	D	0.240		
15-Jun-89	166	1211	11	14.5	15.0	A	0.305		
16-Jun-89	167	1212	121	15.2	14.0	B	1.090		
19-Jun-89	170	1271	660	16.4	16.0	B	0.505	0.844	
20-Jun-89	171	1308	131	15.0	14.0	D	1.361		
21-Jun-89	172	1307	838	14.9	14.0	C	0.379		
22-Jun-89	173	1341	145	15.0	14.0	C	0.505		
23-Jun-89	174	1380	658	16.0	16.0	D	0.507		
26-Jun-89	177	1381	104	15.0	14.0	D	0.363		
27-Jun-89	178	1376	175	18.5	18.0	C	0.636		
27-Jun-89	178	1377	698	18.5	18.0	C	0.640		
28-Jun-89	179	1482	122	14.2	14.0	C	0.433		
29-Jun-89	180	1480	719	16.0	14.0	C	0.158		
30-Jun-89	181	1512	39	15.5	15.0	D	0.239		
03-Jul-89	184	1553	691	15.9	14.0	D	0.630		
05-Jul-89	186	1552	305	16.2	14.0	D	0.255		
06-Jul-89	187	1607	143	15.6	10.0	D	0.282		
07-Jul-89	188	1608	175	15.0	15.0	A	0.569		
10-Jul-89	191	1677	66	16.8	14.0	D	0.658		
11-Jul-89	192	1707	198	15.2	14.0	B	0.509		
12-Jul-89	193	1706	707	15.9	16.0	A	0.353		
13-Jul-89	194	1759	407	15.0	15.0	C	0.417		
14-Jul-89	195	1760	768	16.0	16.0	D	1.112		
17-Jul-89	198	1779	30	16.0	16.0	C	0.197		
18-Jul-89	199	1802	109	16.2	16.0	C	2.302	2.174	
19-Jul-89	200	1803	53	14.8	14.0	C	0.606		
20-Jul-89	201	1857	773	16.0	15.0	D	0.524		
21-Jul-89	202	1902	185	15.2	15.0	D	0.235		
24-Jul-89	205	1901	179	16.0	16.0	A	1.167		
25-Jul-89	206	1935	164	17.3	18.0	B	0.594		
26-Jul-89	207	1936	631	16.1	16.0	B	0.852		
27-Jul-89	208	2008	52	14.6	14.0	D	0.935		
28-Jul-89	209	2009	838	15.0	14.0	D	0.417		
31-Jul-89	212	2014	691	16.1	16.0	B	0.510	0.555	
01-Aug-89	213	2026	301	15.0	15.0	A	0.337		
02-Aug-89	214	2057	899	14.9	14.5	A	0.917		
03-Aug-89	215	2113	623	15.3	16.0	C	0.520		
04-Aug-89	216	2114	885	14.5	14.0	A	0.637		

TABLE C-17. SUMMARY OF THE 1989 NMOC DATA FOR NEWARK, NJ (NWNJ)

Sampling Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC	GAD NMOC ppmc	AREAL NMOC ppmc
08-Aug-89	220	2199	875	15.0	15.0	C	0.254		
09-Aug-89	221	2169	126	18.2	17.0	B	0.319		
09-Aug-89	221	2170	927	18.2	18.0	D	0.298		
10-Aug-89	222	2263	857	15.0	16.0	B	1.097		
11-Aug-89	223	2264	22	15.0	15.0	C	0.263		
14-Aug-89	226	2265	36	14.5	14.0	B	1.356		
15-Aug-89	227	2297	872	15.0	14.5	D	1.981		
16-Aug-89	228	2364	404	15.5	15.0	C	0.551		
17-Aug-89	229	2365	685	15.9	16.0	A	0.586		
18-Aug-89	230	2419	83	17.6	17.5	C	0.324		
18-Aug-89	230	2420	669	17.6	18.0	C	0.296		
21-Aug-89	233	2388	501	15.6	14.0	C	0.216		
22-Aug-89	234	2448	766	14.9	15.0	D	0.307		
23-Aug-89	235	2449	878	14.4	14.0	D	0.497		
24-Aug-89	236	2433	42	15.7	15.0	B	0.315		
25-Aug-89	237	2480	890	17.9	17.0	C	0.248		
25-Aug-89	237	2479	153	17.9	18.0	A	0.177		
28-Aug-89	240	2503	852	15.0	14.5	D	0.979		
29-Aug-89	241	2542	788	16.0	15.0	C	0.450		
30-Aug-89	242	2541	774	15.8	15.0	A	0.740		
31-Aug-89	243	2587	107	15.0	14.0	A	0.370		
01-Sep-89	244	2649	666	19.0	16.0	C	0.788		
01-Sep-89	244	2648	74	19.0	19.0	C	0.839		
05-Sep-89	248	2655	657	16.5	17.0	D	0.272		
06-Sep-89	249	2688	688	16.7	17	C	0.600		
07-Sep-89	250	2686	109	17.1	13.	C	1.708		
08-Sep-89	251	2780	833	15.4	15.0	D	1.679		
11-Sep-89	254	2794	680	16.0	15.0	D	0.470		
12-Sep-89	255	2793	652	16.2	16.0	C	0.329		
13-Sep-89	256	2834	676	16.1	16.0	C	0.491		
15-Sep-89	258	2860	172	15.0	13.0	C	0.532		
18-Sep-89	261	2909	924	15.0	15.0	A	0.614		
19-Sep-89	262	2910	890	15.8	16.0	A	0.299		
20-Sep-89	263	2941	70	18.0	18.0	D	0.463		
20-Sep-89	263	2940	831	18.0	18.0	D	0.518		
21-Sep-89	264	2980	777	15.8	16.0	[illegible]	2.124		
22-Sep-89	265	2979	783	15.8	15.0	B	1.042		
25-Sep-89	268	3014	778	17.5	16.0	D	0.270		
26-Sep-89	269	3077	885	15.2	14.5	D	0.602		
27-Sep-89	270	3079	671	17.0	17.0	A	0.205		
29-Sep-89	272	3114	624	16.1	16.0	C	0.522		
29-Sep-89	272	3118	686	17.2	17.0	D	0.814		

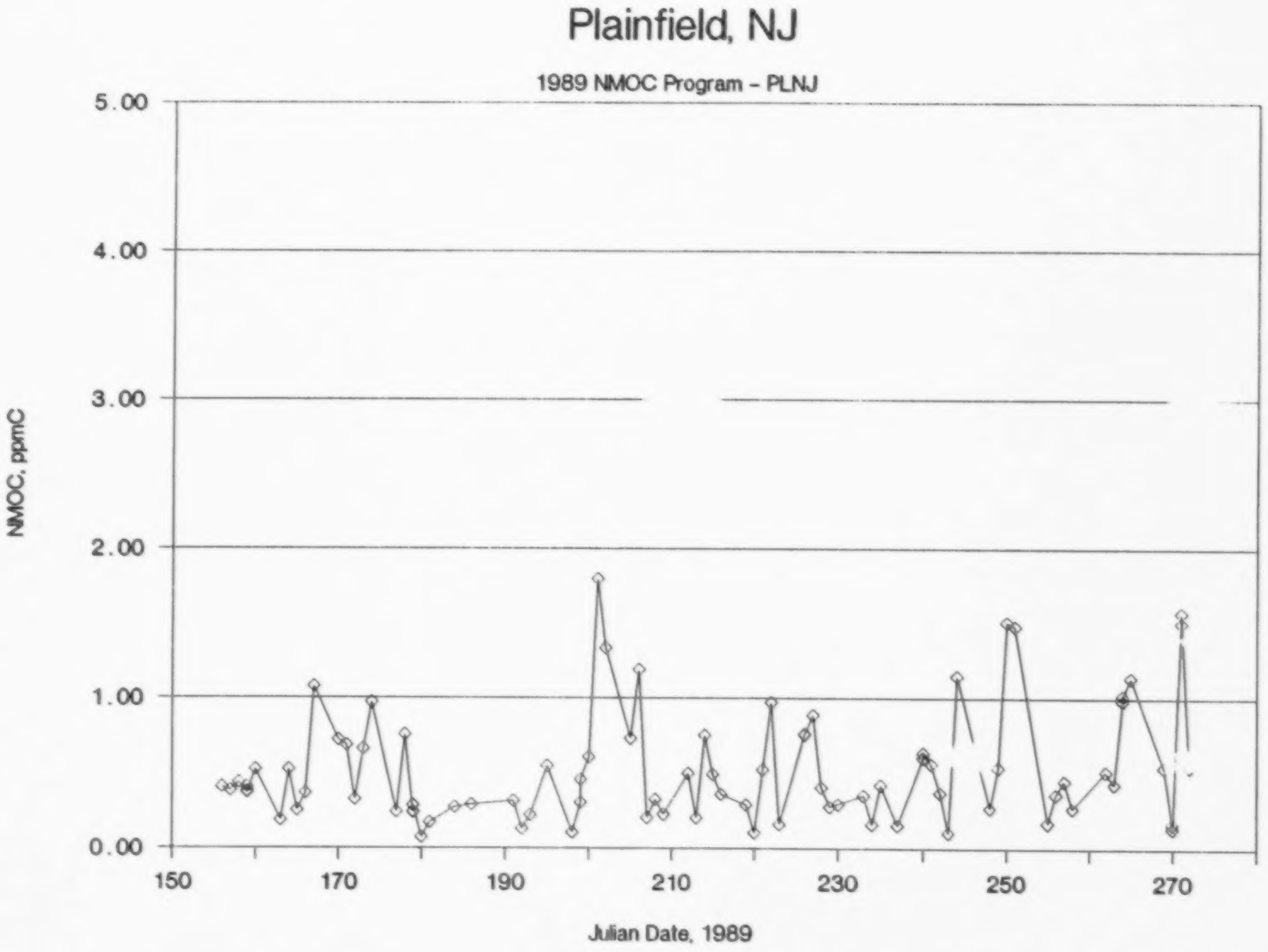

Figure C-18. Plot of NMOC concentration for Plainfield, NJ.

TABLE C-18. SUMMARY OF THE 1989 NMOC DATA FOR PLAINFIELD, NJ (PLNJ)

Sampling Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC	QAD NMOC ppmc	AREAL NMOC ppmc
09-Aug-89	221	2193	698	15.8	15.0	B	0.525		
10-Aug-89	222	2255	684	15.8	19.0	B	0.969		
11-Aug-89	223	2256	895	14.1	17.0	D	0.160		
14-Aug-89	226	2314	777	13.9	16.0	A	0.764		
14-Aug-89	226	2315	184	13.9	17.0	D	0.758		
15-Aug-89	227	2303	193	14.2	17.0	C	0.888		
16-Aug-89	228	2343	885	14.0	14.0	C	0.405		
17-Aug-89	229	2342	121	14.1	12.0		0.274		
18-Aug-89	230	2409	655	15.7	18.0	[illegible]	0.294		
21-Aug-89	233	2413	6	13.3	16.0	C	0.353		
21-Aug-89	233	2414	304	13.3	16.0	D	0.351		
22-Aug-89	234	2453	704	13.0	16.0	D	0.161		
23-Aug-89	235	2454	803	14.8	18.0	C	0.425		
25-Aug-89	237	2525	79	14.3	17.0	C	0.152		
28-Aug-89	240	2513	53	13.6	16.0	A	0.607		
28-Aug-89	240	2514	176	13.6	16.0	D	0.638		
29-Aug-89	241	2607	856	14.2	17.0	A	0.565		
30-Aug-89	242	2608	87	13.9	16.0	C	0.371		
31-Aug-89	243	2586	875	14.3	15.0	A	0.105		
01-Sep-89	244	2660	815	14.2	17.0	C	1.147		
05-Sep-89	248	2670	773	14.8	18.0	D	0.268		
06-Sep-89	249	2680	662	15.9	18.0	C	0.540		
07-Sep-89	250	2681	624	15.9	18.0	B	1.508		
08-Sep-89	251	2781	142	14.2	16.0	A	1.479		
12-Sep-89	255	2789	303	14.3	16.0	D	0.168		
13-Sep-89	256	2824	713	15.5	15.0	C	0.359		
14-Sep-89	257	2872	52	13.9	16.0	A	0.451		
15-Sep-89	258	2875	663	15.0	16.0	C	0.267		
18-Sep-89	261	2927	150	14.2	16.0	D	0.163		
19-Sep-89	262	2933	66	15.3	16.0	D	0.513		
20-Sep-89	263	2930	696	15.4	18.0	C	0.431		
21-Sep-89	264	2985	848	13.5	15.0	B	0.982		
21-Sep-89	264	2986	102	13.6	16.0	C	1.018		
22-Sep-89	265	3026	165	14.0	16.0	C	1.134		
26-Sep-89	269	3040	189	14.3	17.0	C	0.541		
27-Sep-89	270	3051	643	14.8	18.0	B	0.162		
27-Sep-89	270	3050	656	14.8	18.0	B	0.134		
28-Sep-89	271	3056	819	14.2	18.0	B	1.503		
28-Sep-89	271	3057	852	14.4	18.0	C	1.570		
29-Sep-89	272	3110	692	15.2	17.0	B	0.542		
29-Sep-89	272	3111	640	15.2	18.0	D	0.557		

TABLE C-18. SUMMARY OF THE 1989 NMOC DATA FOR PLAINFIELD, NJ (PLNJ)

Sampling Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC	QAD NMOC ppmc	AREAL NMOC ppmc
05-Jun-89	156	1040	806	15.4	18.0	A	0.407		
06-Jun-89	157	1097	198	14.0	16.0	B	0.384		
07-Jun-89	158	1105	715	15.4	17.0	C	0.438		
08-Jun-89	159	1076	895	13.4	16.0	C	0.377		
08-Jun-89	159	1077	176	13.4	16.0	D	0.370		
09-Jun-89	160	1148	890	14.1	16.0	B	0.524		
12-Jun-89	163	1147	842	14.1	16.0	D	0.184		
13-Jun-89	164	1179	33	13.9	11.0	C	0.524		
14-Jun-89	165	1178	719	15.4	15.0	D	0.249	0.297	
15-Jun-89	166	1256	834	14.4	14.0	A	0.368		
16-Jun-89	167	1257	777	15.2	15.0	D	1.077		
19-Jun-89	170	1272	825	14.2	16.5	A	0.723	0.721	
20-Jun-89	171	1349	897	14.4	17.0	D	0.686		
21-Jun-89	172	1350	646	15.5	18.0	C	0.327		
22-Jun-89	173	1343	172	14.7	16.0	D	0.664		
23-Jun-89	174	1403	839	14.2	16.0	A	0.968		
26-Jun-89	177	1404	115	14.0	16.0	D	0.241		
27-Jun-89	178	1475	8	13.5	16.0	A	0.757		
28-Jun-89	179	1451	666	14.0	17.0	C	0.287		
28-Jun-89	179	1450	723	14.0	17.0	D	0.235		
29-Jun-89	180	1474	11	14.2	15.0	C	0.072		
30-Jun-89	181	1513	676	15.9	18.0	C	0.170		
03-Jul-89	184	1530	808	15.1	18.0	B	0.273		
05-Jul-89	186	1529	106	14.8	18.0	A	0.288		
10-Jul-89	191	1631	57	14.1	14.0	A	0.316		
11-Jul-89	192	1676	119	14.1	16.0	B	0.128		
12-Jul-89	193	1646	778	15.3	18.0	C	0.218		
14-Jul-89	195	1756	801		18.0	C	0.550		
17-Jul-89	198	1858	676	15.3	17.5	D	0.104		
18-Jul-89	199	1783	4	14.1	17.0	D	0.457		
18-Jul-89	199	1782	724	14.1	17.0	A	0.304		
19-Jul-89	200	1859	186	14.3	17.0	A	0.610		
20-Jul-89	201	1860	28	15.6	17.5	A	1.796		
21-Jul-89	202	1907	143	15.6	18.0	A	1.334		
24-Jul-89	205	1908	652	15.7	14.5	C	0.734		
25-Jul-89	206	1959	790	15.5	18.0	D	1.189		
26-Jul-89	207	1958	697	15.2	18.0	B	0.203		
27-Jul-89	208	2006	137	14.0	14.0	A	0.327		
28-Jul-89	209	2007	681	15.0	18.0	C	0.226		
31-Jul-89	212	2015	872	14.1	17.0	D	0.500		
01-Aug-89	213	2025	18	14.1	17.0	C	0.201		
02-Aug-89	214	2056	920	14.0	16.0	D	0.753		
03-Aug-89	215	2151	914	14.0	16.0	C	0.493		
04-Aug-89	216	2153	834	14.0	16.0	A	0.359		
07-Aug-89	219	2167	629	14.8	17.0	A	0.290		
08-Aug-89	220	2198	35	14.3	15.0	D	0.104		

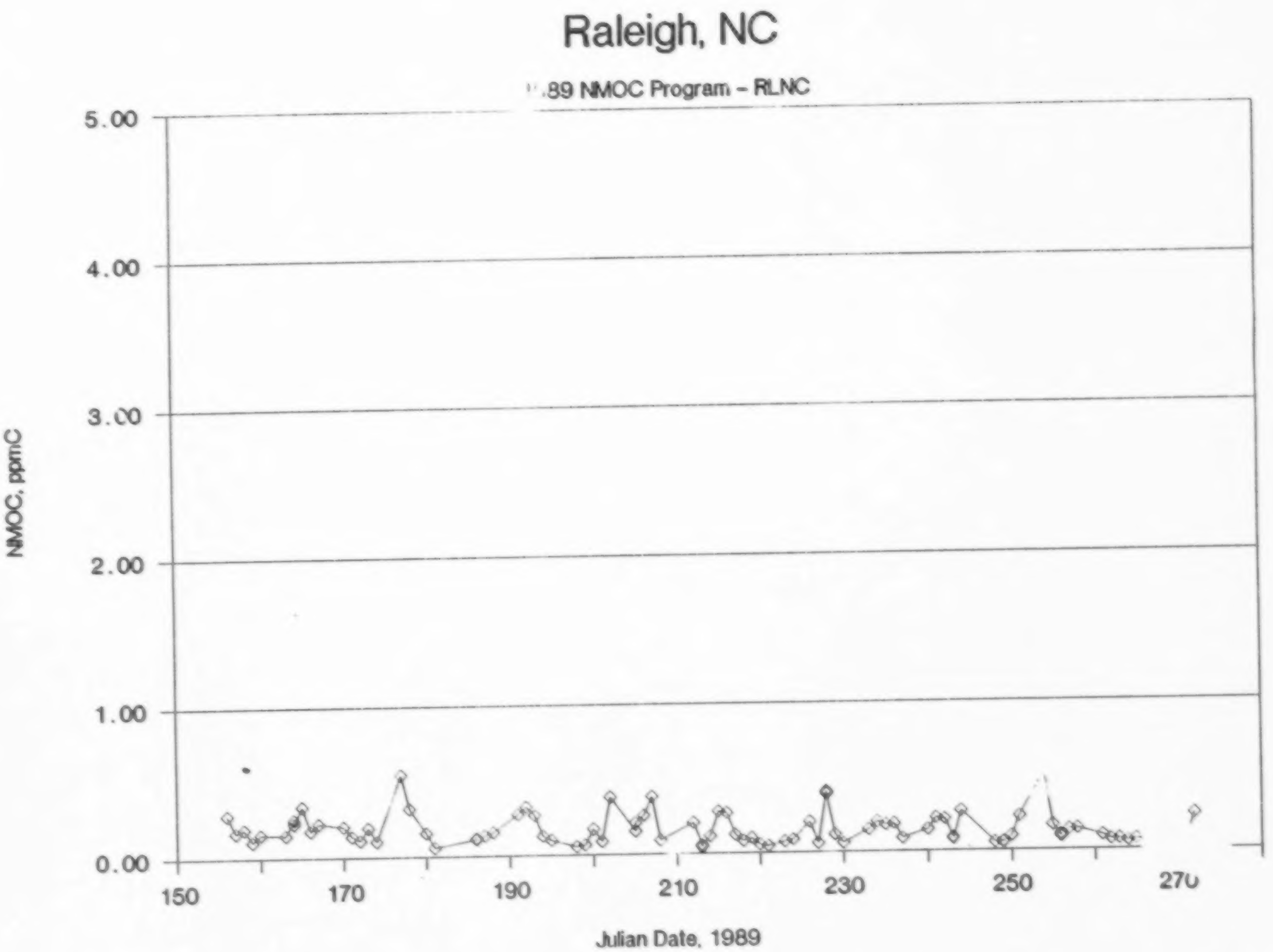

Figure C-19. Plot of NMOC concentration for Raleigh, NC.

TABLE C-19. SUMMARY OF THE 1989 NMOC DATA FOR RALEIGH, NC (RLNC)

Sampling Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC	QAD NMOC ppmc	AREAL NMOC ppmc
05-Jun-89	156	1009	698	17.0	17.0	C	0.286	0.291	
06-Jun-89	157	1010	179	16.0	16.0	D	0.166		
07-Jun-89	158	1049	136	15.0	15.0	B	0.190		
08-Jun-89	159	1050	12	17.0	17.0	D	0.108		
09-Jun-89	160	1071	833	17.0	17.0	D	0.158		
12-Jun-89	163	1125	878	17.0	17.0	D	0.150		
13-Jun-89	164	1126	697	16.0	15.0	A	0.252		
13-Jun-89	164	1127	809	16.0	15.0	A	0.228		
14-Jun-89	165	1176	913	18.0	19.0	C	0.344		
15-Jun-89	166	1177	192	17.0	17.0	B	0.177		
16-Jun-89	167	1249	916	17.0	14.0	C	0.228		
19-Jun-89	170	1246	914	17.0	14.0	D	0.206		
20-Jun-89	171	1248	801	17.0	15.0	A	0.138		
21-Jun-89	172	1295	810	17.0	18.0	C	0.110		
22-Jun-89	173	1296	179	17.0	16.5	B	0.193	0.279	
23-Jun-89	174	1370	671	17.0	17.0	A	0.104		
26-Jun-89	177	1371	834	17.0	16.0	B	0.551		
27-Jun-89	178	1372	45	16.0	16.0	D	0.321		
29-Jun-89	180	1502	74	16.0	17.0	A	0.158		
30-Jun-89	181	1503	108	17.0	17.0	C	0.059		
05-Jul-89	186	1506	767	16.0	16.0	C	0.110		
05-Jul-89	186	1547	804	16.0	16.0	A	0.116		
06-Jul-89	187	1571	84	15.0	14.0	C	0.136		
07-Jul-89	188	1570	684	17.0	17.0	D	0.156		
10-Jul-89	191	1597	33	16.0	14.0	D	0.276		
11-Jul-89	192	1650	52	17.0	16.0	D	0.325		
12-Jul-89	193	1651	685	17.0	17.0	B	0.268		
13-Jul-89	194	1649	875	17.0	15.0	C	0.126		
14-Jul-89	195	1730	91	16.0	16.0	C	0.097		
17-Jul-89	198	1731	136	16.0	16.0	D	0.052		
18-Jul-89	199	1732	184	16.0	16.0	B	0.066	0.101	
19-Jul-89	200	1777	138	17.0	17.0	A	0.169		
20-Jul-89	201	1812	667	18.0	16.0	A	0.087		
21-Jul-89	202	1815	309	16.0	15.0	C	0.386	0.419	
24-Jul-89	205	1864	899	0.0	15.0	C	0.153		
24-Jul-89	205	1865	135	14.0	14.0	A	0.208		
25-Jul-89	206	1886	803	16.0	16.0	C	0.258		
26-Jul-89	207	1896	649	15.0	16.0	D	0.386		
27-Jul-89	208	1913	192	18.0	16.0	A	0.089		
31-Jul-89	212	1970	185	16.5	16.0	B	0.204	0.249	
01-Aug-89	213	2004	84	15.0	15.0	B	0.054		
01-Aug-89	213	2005	684	15.0	15.0	B	0.043		
02-Aug-89	214	2038	192	16.0	16.0	B	0.113		
03-Aug-89	215	2041	57	15.0	16.0	D	0.277		
04-Aug-89	216	2080	107	15.0	16.0	C	0.269		
05-Aug-89	217	2082	198	16.0	16.0	D	0.120	0.175	

TABLE C-19. SUMMARY OF THE 1989 NMOC DATA FOR RALEIGH, NC (RLNC)

Sampling Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC	QAD NMOC ppmC	AREAL NMOC ppmC
06-Aug-89	218	2084	38	16.0	16.0	A	0.079		
07-Aug-89	219	2141	14	16.0	15.0	A	0.099		
08-Aug-89	220	2142	130	16.0	13.0	B	0.054		
09-Aug-89	221	2147	720	18.0	12.5	D	0.046		
11-Aug-89	223	2189	162	16.0	17.0	D	0.074		
12-Aug-89	224	2191	166	16.0	16.0	D	0.083		
14-Aug-89	226	2241	627	16.0	16.0	A	0.201		
15-Aug-89	227	2242	72	16.0	16.0	B	0.056	0.075	
16-Aug-89	228	2288	46	15.0	15.0	B	0.405		
16-Aug-89	228	2289	100	15.0	15.0	C	0.391		
17-Aug-89	229	2311	37	16.0	16.0	C	0.116		
18-Aug-89	230	2319	157	16.0	16.0	D	0.056		
21-Aug-89	233	2393	857	17.0	16.0	A	0.146		
22-Aug-89	234	2394	180	19.0	18.0	C	0.198		
23-Aug-89	235	2395	667	17.0	17.0	B	0.176		
24-Aug-89	236	2571	18	19.0	18.0	A	0.183		
25-Aug-89	[illegible]	2671	395	17.0	17.0	B	0.083		
28-Aug-89	240	2672	106	17.0	17.0	A	0.142		
29-Aug-89	241	2572	871	17.0	16.0	A	0.220		
30-Aug-89	242	2573	900	17.0	16.0	B	0.210		
31-Aug-89	243	2575	658	17.0	16.0	D	0.080		
31-Aug-89	243	2574	698	17.0	16.0	B	0.086		
01-Sep-89	244	2597	98	18.0	16.0	B	0.265	0.310	
05-Sep-89	248	2673	622	19.0	19.0	B	0.052		
06-Sep-89	249	3085	839	16.0	16.0	C	0.050		
06-Sep-89	249	2674	790	18.0	18.0	D	0.054		
07-Sep-89	250	2675	899	18.0	18.0	C	0.092		
08-Sep-89	251	2676	890	18.0	17.0	A	0.226		
11-Sep-89	254	2751	61	17.0	17.0	D	0.525		
12-Sep-89	255	2750	86	17.0	17.0	C	0.163		
13-Sep-89	256	2759	834	16.0	14.0	B	0.098		
13-Sep-89	256	2758	871	16.0	15.0	B	0.083		
14-Sep-89	257	2852	794	17.0	17.0	D	0.135		
15-Sep-89	258	2853	72	17.0	17.0	A	0.137		
18-Sep-89	261	2851	169	17.0	17.0	A	0.092		
19-Sep-89	262	2855	197	17.0	14.5	A	0.065		
20-Sep-89	263	3084	36	16.0	16.0	C	0.068		
21-Sep-89	264	3080	635	17.0	18.0	A	0.053		
22-Sep-89	265	3086	868	17.0	16.0	A	0.065		
25-Sep-89	268	3083	37	17.0	16.0	D	0.046		
26-Sep-89	269	3087	894	16.0	16.0	C	0.086		
27-Sep-89	270	3088	68	17.0	18.0	B	0.049		
28-Sep-89	271	3082	27		18.0	D	0.056		
29-Sep-89	272	3081	875	18.0	17.0	D	0.232		

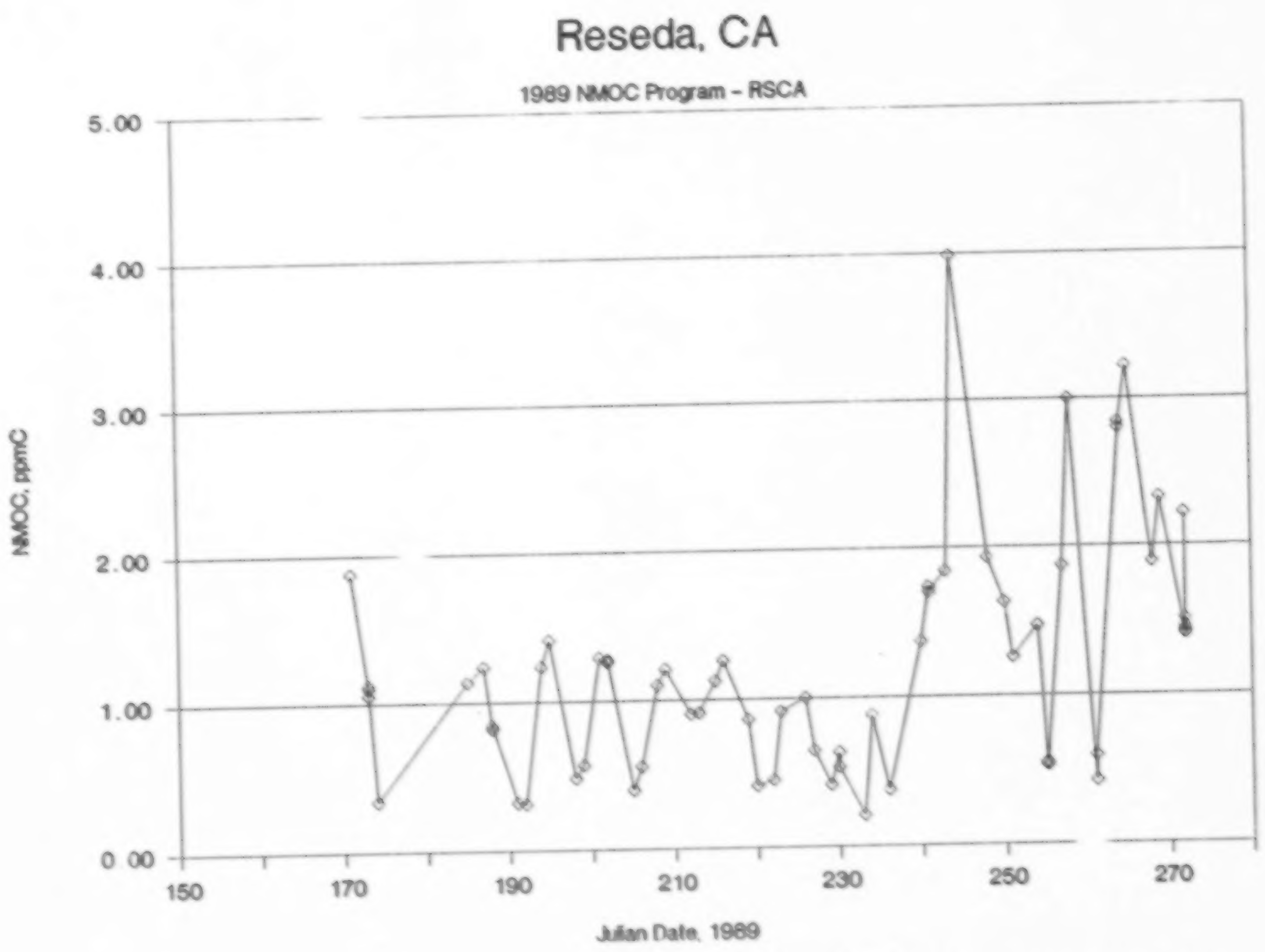

Figure C-20. Plot of NMOC concentration for Reseda, CA.

TABLE C-20. SUMMARY OF THE 1989 NMOC DATA FOR RESEDA, CA (RSCA)

Sampling Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC	GAD NMOC ppmc	AREAL NMOC ppmc
20-Jun-89	171	1292	4	18.0	14.0	C	1.876		
22-Jun-89	173	1336	193	18.0	14.0	B	1.102		
22-Jun-89	173	1335	853	18.0	14.0	B	1.102		
23-Jun-89	174	1356	113	18.0	12.0	B	0.340	0.408	
04-Jul-89	185	1561	642	18.0	12.0	B	1.134		
06-Jul-89	187	1559	123	17.0	12.0	D	1.238		
07-Jul-89	188	1596	658	14.0	8.0	C	0.842		
07-Jul-89	188	1579	924	14.0	10.0	B	0.820		
10-Jul-89	191	1616	135	17.0	12.0	C	0.323		
11-Jul-89	192	1645	79	17.0	14.0	D	0.314		
13-Jul-89	194	1687	181	17.0	12.0	A	1.236		
14-Jul-89	195	1716	806	17.0	15.0	D	1.414		
17-Jul-89	198	1735	107	17.0	14.0	D	0.483		
18-Jul-89	199	1765	860	17.0	14.0	D	0.571		
20-Jul-89	201	1837	122	17.0	14.0	C	1.289		
21-Jul-89	202	1819	99	13.0	13.0	B	1.262		
21-Jul-89	202	1820	119	13.0	13.0	D	1.275		
24-Jul-89	205	1879	684	18.0	15.0	A	0.399	0.446	
25-Jul-89	206	1895	172	17.0	14.0	C	0.555		
27-Jul-89	208	1941	646	17.0	14.0	D	1.100	1.143	
28-Jul-89	209	1980	916	17.0	14.0	D	1.209		
31-Jul-89	212	2002	718	18.0	15.0	B	0.904		
01-Aug-89	213	2030	86	17.0	16.0	D	0.912		
03-Aug-89	215	2078	833	17.0	14.0	D	1.125		
04-Aug-89	216	2108	121	17.0	14.0	D	1.260		
07-Aug-89	219	2132	145	17.0	14.0	C	0.863		
08-Aug-89	220	2146	183	17.0	13.0	A	0.417		
10-Aug-89	222	2207	662	18.0	15.0	D	0.455		
11-Aug-89	223	2211	70	17.0	14.0	D	0.913		
14-Aug-89	226	2248	43	16.5	14.0	D	1.002		
15-Aug-89	227	2267	114	18.0	15.0	A	0.648	0.666	
17-Aug-89	229	2329	56	19.0	15.0	C	0.417		
18-Aug-89	230	2366	113	12.5	10.0	C	0.635		
18-Aug-89	230	2367	155	13.0	12.0	C	0.536		
21-Aug-89	233	2381	722	19.5	19.0	C	0.209		
22-Aug-89	234	2410	842	19.0	16.0	A	0.879		
24-Aug-89	236	2457	921	19.0	16.0	B	0.380		
28-Aug-89	240	2490	718	19.5	16.0	A	1.370		
29-Aug-89	241	2519	145	18.0	15.0	B	1.735		
29-Aug-89	241	2520	899	18.0	15.0	D	1.703		
31-Aug-89	243	2599	32	18.0	15.0	C	1.843	1.729	1.799
01-Sep-89	244	2614	806	25.0	21.0	A	3.990		
05-Sep-89	248	2640	183	17.0	14.0	B	1.930		
07-Sep-89	250	2677	697	19.0	16.0	D	1.630		
08-Sep-89	251	2718	56	18.0	15.0	C	1.258		
11-Sep-89	254	2747	403	19.0	15.0	C	1.470		

TABLE C-20. SUMMARY OF THE 1989 NMOC DATA FOR RESEDA, CA (RSCA)

Sampling Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC	GAD NMOC ppmc	AREAL NMOC ppmc
12-Sep-89	255	2766	185	18.0	14.0	D	0.550		
12-Sep-89	255	2765	770	18.0	14.0	A	0.535		
14-Sep-89	257	2816	140	18.0	15.0	A	1.867		
15-Sep-89	258	2848	810	19.0	15.0	C	3.000		
18-Sep-89	261	2871	852	19.0	14.0	C	0.593		
18-Sep-89	261	2866	698	19.0	15.0	B	0.424		
21-Sep-89	264	2946	10	18.0	15.0	B	2.839		
21-Sep-89	264	2945	634	18.0	15.0	B	2.800		
22-Sep-89	265	2970	788	19.0	16.0	C	3.222		
25-Sep-89	268	2991	762	19.0	16.0	D	1.890		
26-Sep-89	269	3011	928	19.0	16.0	B	2.327		
28-Sep-89	271	3107	657	19.0	16.0	C	2.216		
29-Sep-89	272	3089	403	18.0	15.0	B	1.420		
29-Sep-89	272	3090	145	18.0	17.0	D	1.407		

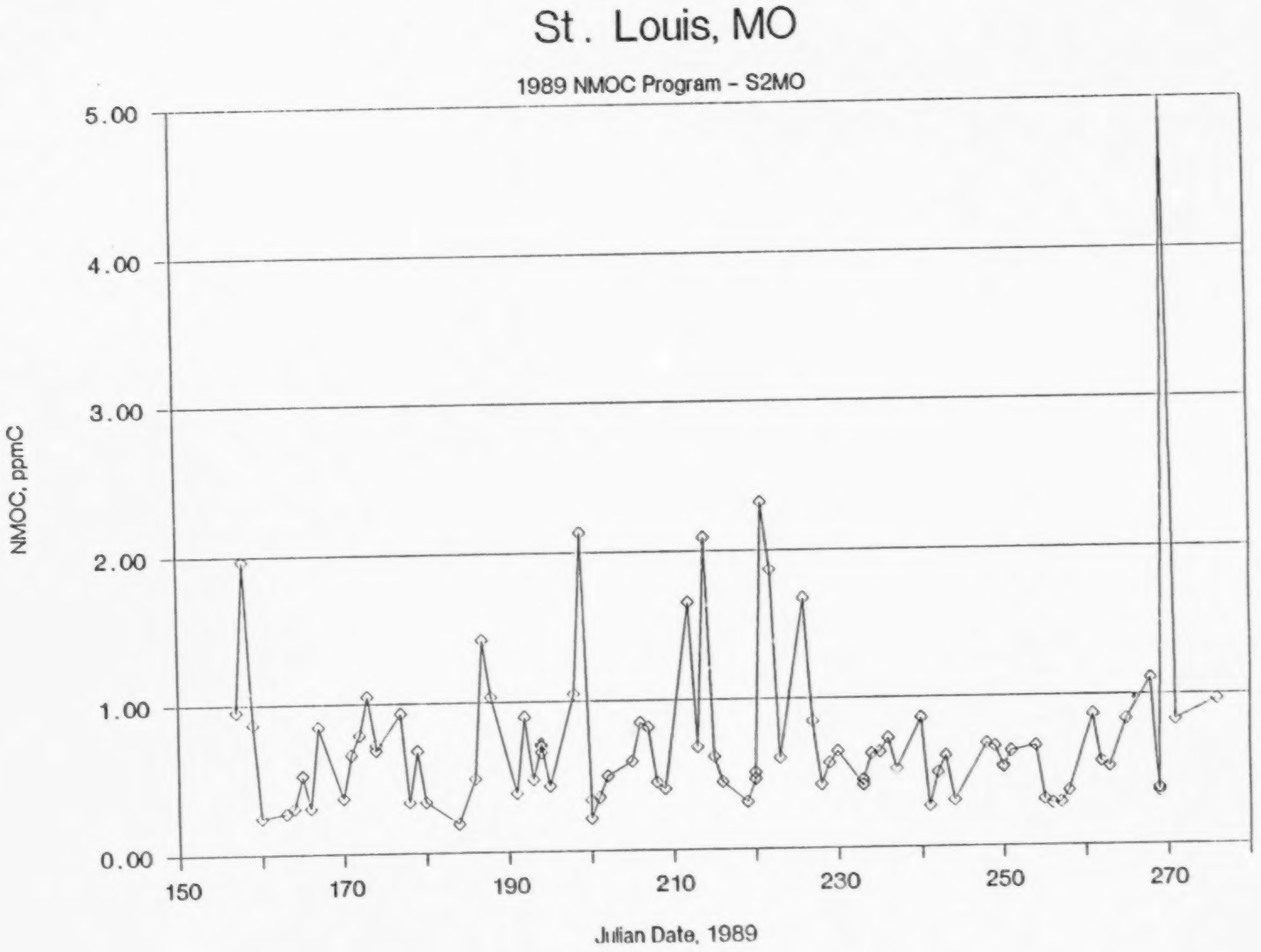

Figure C-21. Plot of NMOC concentration for St. Louis, MO.

TABLE C-21. SUMMARY OF THE 1989 NMOC DATA FOR ST. LOUIS, MO (S2MO)

Sampling Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC	QAD NMOC ppmc	AREAL NMOC ppmc
06-Jun-89	157	1027	166	16.0	16.0	A	0.951		
07-Jun-89	158	1056	650	16.0	15.0	A	1.967		
08-Jun-89	159	1120	864	15.0	15.0	B	0.870		
09-Jun-89	160	1121	184	15.0	15.0	D	0.240		
12-Jun-89	163	1129	774	16.0	16.0	D	0.269	0.345	
13-Jun-89	164	1187	183	15.0	14.0	C	0.303		
14-Jun-89	165	1203	90	16.0	16.0	A	0.519		
14-Jun-89	165	1204	696	16.0	16.0	C	0.524		
15-Jun-89	166	1227	775	15.0	12.0	B	0.303		
16-Jun-89	167	1247	666	16.0	12.0	C	0.848		
19-Jun-89	170	1266	661	16.0	12.0	D	0.364		
20-Jun-89	171	1288	135	14.0	14.0	D	0.661		
21-Jun-89	172	1319	872	14.0	14.0	D	0.791		
22-Jun-89	173	1361	778	16.0	16.0	D	1.048		
23-Jun-89	174	1369	68	16.0	14.0	C	0.691		
23-Jun-89	174	1368	842	16.0	15.0	B	0.724		
26-Jun-89	177	1397	304	14.0	13.0	A	0.932	0.964	
27-Jun-89	178	1413	801	15.0	14.0	A	0.338		
28-Jun-89	179	1458	657	14.0	13.0	D	0.682		
29-Jun-89	180	1444	916	10.5	11.0	A	0.334		
03-Jul-89	184	1525	17	16.0	15.0	C	0.187		
05-Jul-89	186	1541	56	16.0	15.0	D	0.490		
06-Jul-89	187	1558	185	17.0	16.0	A	1.415		
07-Jul-89	188	1621	789	17.0	16.0	D	1.034		
10-Jul-89	191	1617	627	16.0	16.0	C	0.388		
11-Jul-89	192	1652	405	16.0	14.0	B	0.900	0.805	
12-Jul-89	193	1656	15	15.0	15.0	A	0.481		
13-Jul-89	194	1727	776	16.0	16.0	D	0.659		
13-Jul-89	194	1726	828	16.0	16.0	C	0.706		
14-Jul-89	195	1713	854	16.5	16.0	A	0.432		
17-Jul-89	198	1744	157	16.5	16.0	C	1.049		
18-Jul-89	199	1772	400	16.5	16.0	C	2.132		
19-Jul-89	200	1810	696	17.0	16.0	B	0.335		
19-Jul-89	200	1811	786	17.0	16.0	B	0.210		
20-Jul-89	201	1843	688	16.5	16.0	D	0.350		
21-Jul-89	202	1850	685	16.5	16.0	B	0.498		
24-Jul-89	205	1878	657	17.0	17.0	B	0.596		
25-Jul-89	206	1900	680	17.5	17.0	A	0.850		
26-Jul-89	207	1925	90	16.0	16.0	B	0.821		
27-Jul-89	208	1948	723	17.0	17.0	C	0.453		
28-Jul-89	209	1972	696	16.5	16.5	C	0.404	0.434	
31-Jul-89	212	2003	15	16.0	15.0	C	1.653		
01-Aug-89	213	2051	106	16.0	15.0	D	0.685		
02-Aug-89	214	2048	186	16.0	16.0	C	2.090		
03-Aug-89	215	2067	652	17.0	16.0	C	0.622		
04-Aug-89	216	2100	631	17.0	16.0	A	0.447		

TABLE C-21. SUMMARY OF THE 1989 NMOC DATA FOR ST. LOUIS, MO (S2MO)

Sampling Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC	QAD NMOC ppmc	AREAL NMOC ppmc
07-Aug-89	219	2139	179	16.0	15.0	D	0.311		
08-Aug-89	220	2149	105	16.0	16.0	B	0.470		
08-Aug-89	220	2150	921	16.0	16.0	C	0.508		
09-Aug-89	221	2185	620	16.5	16.0	D	2.323		
10-Aug-89	222	2219	874	16.0	16.0	A	1.868		
11-Aug-89	223	2239	192	15.0	16.0	D	0.608		
14-Aug-89	226	2247	831	12.0	12.0	C	1.670		
15-Aug-89	227	2292	640	16.0	15.0	A	0.849		
16-Aug-89	228	2322	852	16.0	14.0	A	0.420		
17-Aug-89	229	2327	825	16.0	14.0	A	0.568		
18-Aug-89	230	2324	98	80.0	18.0	C	0.647		
21-Aug-89	233	2373	147	16.0	16.0	D	0.419		
21-Aug-89	233	2372	403	16.0	16.0	C	0.412		
22-Aug-89	234	2405	768	16.5	16.0	C	0.626		
23-Aug-89	235	2425	874	15.0	15.0	C	0.639		
24-Aug-89	236	2466	43	15.5	15.0	C	0.727		
25-Aug-89	237	2481	634	16.0	16.0	A	0.520		
28-Aug-89	240	2496	924	15.5	16.0	C	0.861		
29-Aug-89	241	2508	10	16.0	15.0	D	0.271		
30-Aug-89	242	2545	837	15.0	14.0	A	0.494		
31-Aug-89	243	2584	62	15.0	14.0	D	0.606		
01-Sep-89	244	2624	15	16.0	15.5	C	0.303		
05-Sep-89	248	2630	765	17.0	15.0	D	0.684		
06-Sep-89	249	2668	878	16.0	15.0	B	0.666		
07-Sep-89	250	2683	684	17.0	17.0	A	0.524		
07-Sep-89	250	2682	707	17.0	17.0	A	0.546		
08-Sep-89	251	2727	145	15.0	15.0	C	0.632		
11-Sep-89	254	2744	658	16.0	15.0	D	0.665		
12-Sep-89	255	2802	181	15.0	15.0	D	0.304		
13-Sep-89	256	2803	767	16.0	16.0	D	0.275		
14-Sep-89	257	2831	921	15.0	15.0	A	0.282		
15-Sep-89	258	2845	89	15.0	15.0	C	0.360		
18-Sep-89	261	2890	796	16.0	15.0	B	0.871		
19-Sep-89	262	2893	720	16.0	16.0	A	0.556		
20-Sep-89	263	2968	83	15.0	15.0	C	0.519		
22-Sep-89	265	2961	871	15.0	15.0	D	0.836		
25-Sep-89	268	2994	151	15.0	15.0	A	1.110		
26-Sep-89	269	3004	858	15.0	14.0	D	0.367		
26-Sep-89	269	3003	828	15.0	15.0	A	0.367		
27-Sep-89	270	3059	109	17.0	11.0	B	5.013		
28-Sep-89	271	3067	142	15.0	15.0	D	0.828		
29-Sep-89	276	3093	649	16.0	15.0	A	0.963		

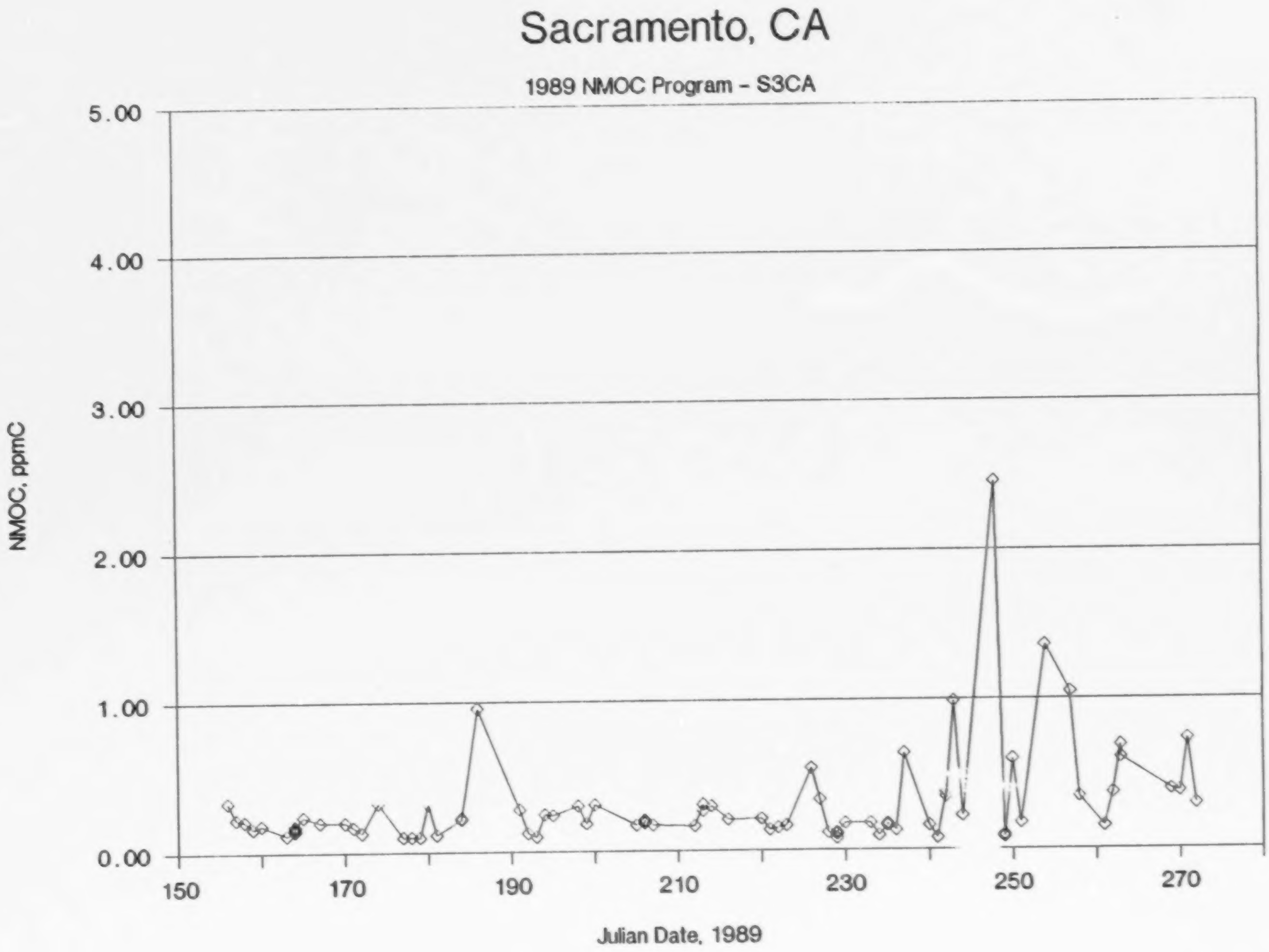

Figure C-22. Plot of NMOC concentration for Sacramento, CA (T St.).

TABLE C-22. SUMMARY OF THE 1989 NMOC DATA FOR SACRAMENTO, CA (S3CA)

Sampling Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC	QAD NMOC ppmc	AREAL NMOC ppmc
05-Jun-89	156	1022	157	9.5	10.0	B	0.333		
06-Jun-89	157	1029	661	10.0	11.0	C	0.221		
07-Jun-89	158	1070	784	10.0	11.0	A	0.208		
08-Jun-89	159	1124	673	18.5	20.0	C	0.161		
09-Jun-89	160	1115	793	13.5	14.0	C	0.180		
12-Jun-89	163	1150	126	12.0	14.0	C	0.115		
13-Jun-89	164	1159	42	18.0	18.0	A	0.164		
13-Jun-89	164	1160	188	18.0	18.0	A	0.155		
14-Jun-89	165	1206	671	17.5	17.0	D	0.236		
16-Jun-89	167	1245	776	9.8	8.0	C	0.199		
19-Jun-89	170	1261	793	10.0	9.0	A	0.198		
20-Jun-89	171	1289	692	16.0	18.0	D	0.166		
21-Jun-89	172	1299	62	9.8	10.0	B	0.129	0.173	
23-Jun-89	174	1395	705	9.8	10.0	C	0.329		
26-Jun-89	177	1375	766	20.0	20.0	B	0.097	0.128	
27-Jun-89	178	1411	773	8.0	8.0	B	0.101		
28-Jun-89	179	1434	864	8.8	8.0	B	0.097		
29-Jun-89	180	1491	183	8.0	9.0	B	0.322		
30-Jun-89	181	1492	635	8.2	8.0	D	0.116		
03-Jul-89	184	1515	186	18.0	20.0	C	0.224		
03-Jul-89	184	1514	696	18.0	20.0	A	0.216		
05-Jul-89	186	1563	60	8.0	6.0	C	0.958		
10-Jul-89	191	1624	772	18.0	18.0	B	0.281		
11-Jul-89	192	1637	652	8.0	9.0	C	0.121		
12-Jul-89	193	1655	644	8.0	9.0	D	0.095		
13-Jul-89	194	1689	406	7.8	7.0	D	0.248		
14-Jul-89	195	1745	656	10.6	13.0	B	0.242		
17-Jul-89	198	1740	813	19.0	20.0	D	0.302		
18-Jul-89	199	1774	789	8.0	10.0	B	0.183		
19-Jul-89	200	1794	642	9.0	10.0	D	0.311		
24-Jul-89	205	1882	623	11.0	13.0	A	0.171		
25-Jul-89	206	1909	61		20.0	C	0.186		
25-Jul-89	206	1910	668	18.0	19.0	D	0.206		
26-Jul-89	207	1921	620	9.0	11.0	A	0.170		
28-Jul-89	209	1978	62	18.0	18.5	C	0.191		
31-Jul-89	212	2034	638	8.5	10.0	D	0.164		
01-Aug-89	213	2017	56	7.0	8.0	B	0.264		
01-Aug-89	213	2016	831	7.0	8.0	B	0.310		
02-Aug-89	214	2047	11	8.0	9.0	C	0.299		
04-Aug-89	216	2117	762	19.0	20.0	C	0.204		
08-Aug-89	220	2144	119	18.0	16.0	B	0.207		
08-Aug-89	220	2145	39	18.0	18.0	C	0.212		
09-Aug-89	221	2171	30	7.8	9.0	D	0.134	0.175	
10-Aug-89	222	2217	789	18.0	20.0	B	0.150		
11-Aug-89	223	2237	407	8.0	9.0	C	0.162		
14-Aug-89	226	2250	773	8.0	10.0	C	0.547		

TABLE C-22. SUMMARY OF THE 1989 NMOC DATA FOR SACRAMENTO, CA (S3CA)

Sampling Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC	QAD NMOC ppmc	AREAL NMOC ppmc
15-Aug-89	227	2269	790	8.8	9.0	A	0.340		
16-Aug-89	228	2296	188	18.0	18.0	D	0.111		
17-Aug-89	229	2346	672	18.3	20.0	B	0.103		
17-Aug-89	229	2347	794	18.3	20.0	[illegible]	0.105		
18-Aug-89	230	2320	734	8.0	10.0	[illegible]	0.178	0.233	
21-Aug-89	233	2371	107	8.0	8.0	C	0.177		
22-Aug-89	234	2435	695	20.0	20.0	C	0.092		
23-Aug-89	235	2439	49	20.0	17.0	A	0.163		
23-Aug-89	235	2438	838	20.0	19.0	A	0.163		
24-Aug-89	236	2459	723	11.0	11.0	B	0.128		
25-Aug-89	237	2477	778	11.0	11.0	C	0.647		
28-Aug-89	240	2497	37	20.0	19.0	B	0.160		
29-Aug-89	241	2544	719	11.0	10.0	C	0.075		
30-Aug-89	242	2540	678	20.0	20.0	C	0.354		
30-Aug-89	242	2539	762	20.0	20.0	D	0.382		
31-Aug-89	243	2551	28	11.5	10.5	D	0.986		
01-Sep-89	244	2596	301	23.0	22.0	A	0.223		
05-Sep-89	248	2616	143	12.0	11.0	D	2.452	2.434	
06-Sep-89	249	2658	304	19.0	17.0	D	0.079		
06-Sep-89	249	2657	35	19.0	19.0	D	0.094		
07-Sep-89	250	2701	10	20.0	20.0	B	0.600		
08-Sep-89	251	2693	924	6.0	6.0	C	0.174		
11-Sep-89	254	2778	64	18.0	19.0	A	1.357		
14-Sep-89	257	2827	675	20.0	20.0	A	1.046		
15-Sep-89	258	2837	306	7.0	6.0	D	0.348		
18-Sep-89	261	2870	671	20.0	19.0	C	0.150		
19-Sep-89	262	2887	35	7.0	6.0	C	0.374		
20-Sep-89	263	2891	628	20.0	20.0	D	0.690		
20-Sep-89	263	2892	728	20.0	20.0	D	0.609		
26-Sep-89	269	3047	627	14.0	15.0	D	0.392		
27-Sep-89	270	3033	774	20.0	20.0	D	0.382		
28-Sep-89	271	3066	71	12.5	14.0	C	0.729		
29-Sep-89	272	3068	406	12.0	15.0	D	0.297		

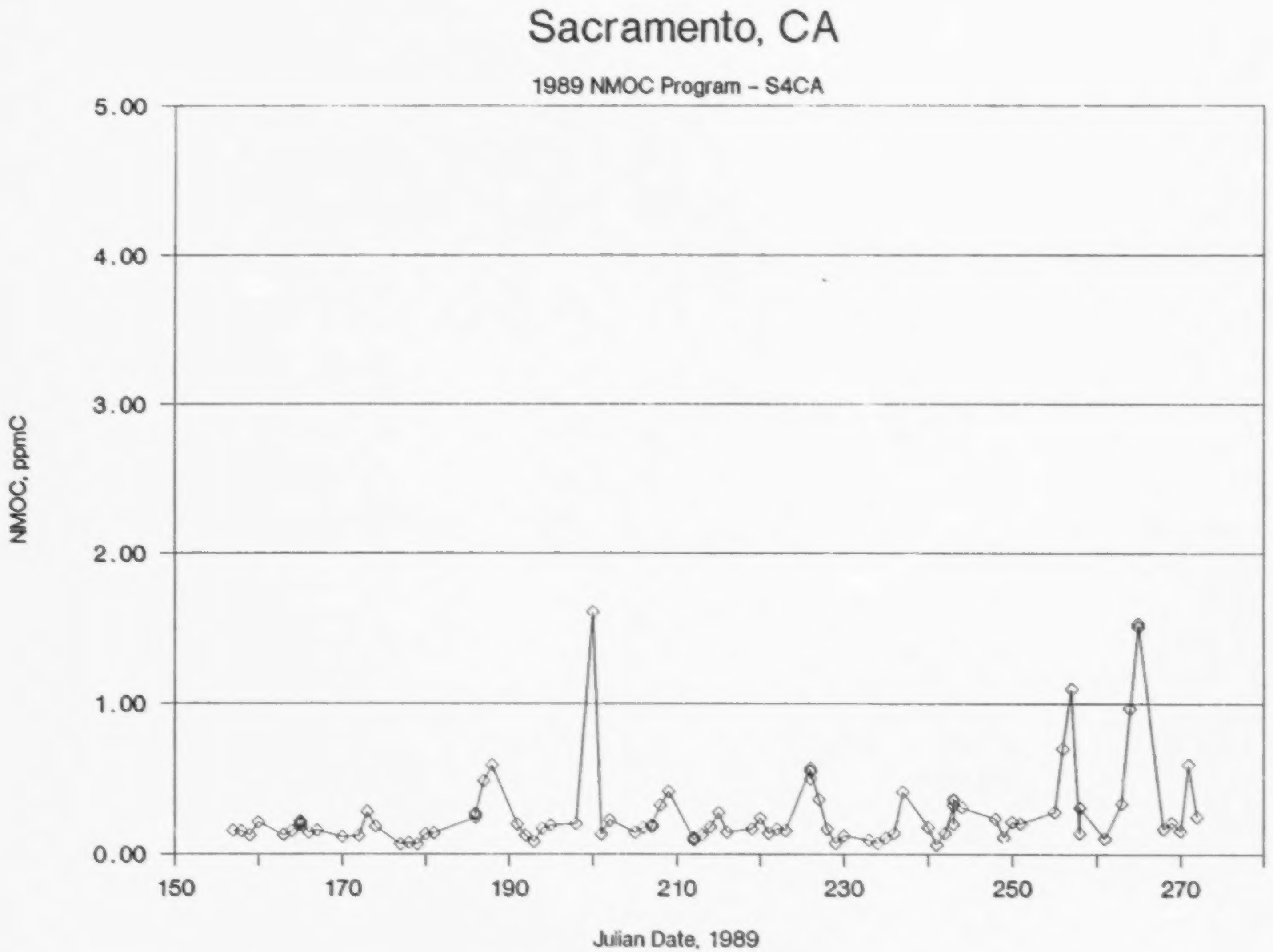

Figure C-23. Plot of NMOC concentration for Sacramento, CA (Avalon Dr.).

TABLE C-23. SUMMARY OF THE 1989 NMOC DATA FOR SACRAMENTO, CA (S4CA)

Sampling Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC	QAD NMOC ppmc	AREAL NMOC ppmc
05-Jun-89	156	1024	121	12.0	12.0	A	0.180		
06-Jun-89	157	1023	788	16.0	18.0	B	0.154		
07-Jun-89	158	1064	870	16.0	16.0	B	0.152	0.256	
08-Jun-89	159	1142	684	16.0	18.0	B	0.125		
09-Jun-89	160	1154	66	14.0	12.0	D	0.210		
12-Jun-89	163	1130	860	15.5	17.0	C	0.127	0.135	
13-Jun-89	164	1169	53	15.5	18.0	C	0.153		
14-Jun-89	165	1192	63	17.0	18.0	C	0.217		
14-Jun-89	165	1191	148	17.0	18.0	A	0.205		
15-Jun-89	166	1221	623	16.0	12.0	D	0.144		
16-Jun-89	167	1239	723	16.0	17.0	C	0.156		
19-Jun-89	170	1265	91	16.0	14.0	C	0.114		
21-Jun-89	172	1315	691	16.5	18.0	D	0.120		
22-Jun-89	173	1338	819	15.0	17.0	B	0.281		
23-Jun-89	174	1364	677	16.0	17.0	D	0.182		
26-Jun-89	177	1391	7	15.0	17.0	B	0.066		
27-Jun-89	178	1412	302	15.0	17.0	B	0.076		
28-Jun-89	179	1481	726	16.0	18.0	B	0.064		
29-Jun-89	180	1483	157	15.5	17.0	B	0.131		
30-Jun-89	181	1500	854	16.0	16.0	D	0.138		
05-Jul-89	186	1531	626	18.0	18.0	A	0.244		
05-Jul-89	186	1532	637	18.0	19.0	C	0.273		
06-Jul-89	187	1567	12	15.0	15.0	B	0.487		
07-Jul-89	188	1584	718	16.0	16.0	C	0.591		
10-Jul-89	191	1626	689	16.0	16.0	D	0.199		
11-Jul-89	192	1644	115	15.0	18.0	C	0.124		
12-Jul-89	193	1672	692	16.0	17.0	C	0.081		
13-Jul-89	194	1721	791	16.0	18.0	B	0.172		
14-Jul-89	195	1715	666	16.0	18.0	B	0.190		
17-Jul-89	198	1743	108	15.0	17.0	A	0.202		
19-Jul-89	200	1791	97	15.0	17.0	D	1.610		
20-Jul-89	201	1814	627	16.0	15.0	D	0.131	0.200	
21-Jul-89	202	1856	929	16.0	17.0	C	0.225		
24-Jul-89	205	1873	692	16.0	19.0	A	0.142		
25-Jul-89	206	1892	842	15.0	17.0	B	0.176		
26-Jul-89	207	1929	64	17.0	19.0	D	0.190		
26-Jul-89	207	1930	105	17.0	19.0	D	0.195		
27-Jul-89	208	1947	169	15.0	17.0	C	0.327		
28-Jul-89	209	1977	75	16.0	17.0	B	0.416		
31-Jul-89	212	1990	83	17.0	17.0	D	0.092		
31-Jul-89	212	1989	813	17.0	19.0	A	0.101		
01-Aug-89	213	2031	79	15.0	17.0	C	0.129		
02-Aug-89	214	2050	665	16.0	17.0	C	0.181		
03-Aug-89	215	2070	842	15.0	16.0	C	0.274		
04-Aug-89	216	2136	406	16.0	17.0	D	0.146		
07-Aug-89	219	2138	645	16.0	17.0	C	0.166		

TABLE C-23. SUMMARY OF THE 1989 NMOC DATA FOR SACRAMENTO, CA (S4CA)

Sampling Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC	QAD NMOC ppmc	AREAL NMOC ppmc
08-Aug-89	220	2158	155	15.0	17.0	C	0.239		
09-Aug-89	221	2181	305	15.0	16.0	C	0.139		
10-Aug-89	222	2210	778	16.0	18.0	D	[illegible]		
11-Aug-89	223	2233	643	16.0	14.0	D	[illegible]		
14-Aug-89	226	2262	106	17.0	19.0	D	0.552		
14-Aug-89	226	2261	772	17.0	19.0	A	0.571		
15-Aug-89	227	2291	104	15.0	17.0	D	0.362		
16-Aug-89	228	2302	122	15.0	14.0	A	0.165		
17-Aug-89	229	2356	62	15.0	15.0	A	0.072		
18-Aug-89	230	2368	775	16.0	18.0	A	0.122		
21-Aug-89	233	2374	21	16.0	[illegible]	A	0.093		
22-Aug-89	234	2421	90	16.0	[illegible]	B	0.072		
23-Aug-89	235	2431	657	16.0	18.0	C	0.106		
24-Aug-89	236	2464	696	16.0	18.0	C	0.139		
25-Aug-89	237	2472	801	16.0	18.0	C	0.414		
28-Aug-89	240	2491	823	15.0	14.0	D	0.178		
29-Aug-89	241	2509	171		18.0	D	0.062		
30-Aug-89	242	2552		15.0	16.5	D	0.139		
31-Aug-89	243	2577		18.0	17.0	C	0.364		
31-Aug-89	243	2578	501	18.0	17.0	B	0.199		
01-Sep-89	244	2611	197	15.0	16.0	C	0.310		
05-Sep-89	248	2650	683	16.0	18.0	B	0.233		
06-Sep-89	249	2667	720	16.0	18.0	B	0.109		
07-Sep-89	250	2694	715	16.0	18.0		0.213		
08-Sep-89	251	2714	646	16.0	18.0		0.203		
12-Sep-89	255	2764	632	16.0	17.0		0.277		
13-Sep-89	256	2798	673	16.0	18.0	C	0.700		
14-Sep-89	257	2817	925	16.0	16.0	D	1.098		
15-Sep-89	258	2838	74	17.0	18.0	B	0.313		
15-Sep-89	258	2839	105	17.0	18.0	B	0.306		
18-Sep-89	261	2865	155	16.0	9.0	D	0.103		
20-Sep-89	263	2925	914	16.0	17.0	D	0.336		
21-Sep-89	264	2947	122	16.0	17.0	B	0.967		
22-Sep-89	265	2956	833	17.0	18.0	B	1.510		
22-Sep-89	265	2955	850	17.0	18.0	A	1.534		
25-Sep-89	268	2998	646	16.0	18.0	B	0.166		
26-Sep-89	269	3007	137	16.0	16.0	B	0.211		
27-Sep-89	270	3036	53	16.0	17.0	A	0.155		
28-Sep-89	271	3078	302	16.0	18.0	A	0.596		
29-Sep-89	272	3100	99	15.0	18.0	C	0.248		

APPENDIX D

1989 NMOC PROGRAM
VOID OR INVALIDATED SAMPLES - CHRONOLOGIAL

#	Site	Date	Description	Assigned
1	S2MO	06/05/89	Canister leak	Canister
2	M1NY	06/05/89	Solenoid failure	Equipment
3	C3IL	06/06/89	Pump not connected to system	Operator
4	MNY	06/06/89	Leak in system	Equipment
5	MNY	06/08/89	Leak in system	Equipment
6	MNY	06/06/89	Leak in system	Equipment
7	H1TX	06/05/89	Pressure too high	Equipment
8	RSCA	06/09/89	Bad fitting on pump	Equipment
9	RSCA	06/12/89	Bad fitting on pump	Equipment
10	RSCA	06/12/89	Bad fitting on pump	Equipment
11	RSCA	06/13/89	Bad fitting on pump	Equipment
12	BACA	06/14/89	Defective orifice	Equipment
13	MGAL	06/15/89	Power outage	Equipment
14	RSCA	06/15/89	Bad fitting on pump	Equipment
15	GRMI	06/16/89	Sampled room air	Operator
16	BACA	06/15/89	Collection missed	Operator
17	RSCA	06/16/89	Bad fitting on pump	Equipment
18	S3CA	06/09/89	Wrong orifice used	Operator
19	MGAL	06/23/89	Sampled room air	Operator
20	MNY	06/28/89	No pressure	Canister
21	MGAL	06/26/89	Pump malfunction	Equipment
22	S2MO	06/30/89	Pump malfunction	Equipment
23	RSCA	06/30/89	No pressure	Canister
24	S4CA	07/03/89	Timer misprogrammed	Operator
25	RSCA	07/03/89	Canister valve not opened	Operator
26	M1NY	07/06/89	Canister valve not opened	Operator
27	S3CA	07/07/89	Sampled room air	Operator
28	C3IL	07/06/89	Defective orifice	Equipment
29	PLNJ	07/07/89	Double collection	Operator
30	PLNJ	07/06/89	Double collection	Operator
31	LBCA	07/12/89	Timer left in manual mode	Operator
32	PLNJ	07/13/89	No pressure	Canister
33	NWNJ	07/17/89	Unknown	Unknown
34	ELCA	07/18/89	Canister valve not opened	Operator
35	S4CA	07/18/89	Timer misprogrammed	Operator
36	S3CA	07/19/89	Orifice improperly installed	Operator
37	C6IL	07/20/89	Timer in manual mode	Operator
38	ELCA	07/21/89	Defective orifice	Equipment
39	H1TX	07/25/89	No pressure	Canister
40	S3CA	07/27/89	Canister valve not opened	Operator
41	C6IL	07/25/89	Collection missed	Operator
42	ALCA	07/27/89	Rotameter improperly installed	Operator
43	C3IL	07/25/89	Collection missed	Operator
44	BACA	07/25/89	Unknown	Unknown
45	H1TX	07/31/89	Canister valve not opened	Operator
46	ELCA	08/01/89	Canister valve not opened	Operator
47	GRMI	07/27/89	No pressure	Equipment

APPENDIX D

1989 NMOC PROGRAM
VOID OR INVALIDATED SAMPLES - CHRONOLOGIAL

#	Site	Date	Description	Assigned
48	H1TX	08/02/89	No pressure	Equipment
49	S3CA	08/03/89	Timer in manual mode	Operator
50	S3CA	08/07/89	Canister not connected	Operator
51	NWNJ	08/07/89	Power outage	Equipment
52	H1TX	08/08/89	No pressure	Operator
53	RLNC	08/10/89	Final pressure to high	Equipment
54	H1TX	08/09/89	Final pressure to high	Equipment
55	ELCA	08/29/89	Timer misprogrammed	Operator
56	BMTX	08/24/89	Cracked fitting	Canister
57	BACA	08/29/89	Defective orifice	Equipment
58	BACA	08/30/89	Canister not connected	Operator
59	FECA	08/15/89	Sampled room air	Operator
60	BACA	08/14/89	Timer malfunction	Operator
61	BACA	08/11/89	Canister valve not opened	Operator
62	GRMI	08/18/89	Canister valve not opened	Operator
63	H1TX	09/06/89	Power outage	Equipment
64	FECA	09/11/89	Timer misprogrammed	Operator
65	FECA	09/12/89	Timer in manual mode	Operator
66	C6IL	09/13/89	Canister valve not opened	Operator
67	S3CA	09/13/89	Unknown	Unknown
68	S3CA	09/13/89	Unknown	Unknown
69	M1NY	09/15/89	Power outage	Equipment
70	C3IL	09/15/89	Duplicate orifice not used	Operator
71	C3IL	09/15/89	Duplicate orifice not used	Operator
72	C6IL	09/15/89	Duplicate orifice not used	Operator
73	C6IL	09/15/89	Duplicate orifice not used	Operator
74	C6IL	09/18/89	Canister valve not opened	Operator
75	S4CA	09/19/89	No pressure	Canister
76	BACA	09/19/89	No pressure	Canister
77	C6IL	09/19/89	Canister valve not opened	Operator
78	S3CA	09/22/89	Oriface cleaned with alcohol	Operator
79	S2MO	09/21/89	Stripped thread on canister valve	Canister
80	S3CA	09/21/89	Oriface cleaned with alcohol	Operator
81	S3CA	09/25/89	Oriface cleaned with alcohol	Operator
82	FECA	09/25/89	No pressure	Operator
83	PLNJ	09/25/89	Power outage	Equipment
84	BMTX	09/28/89	Defective fitting	Equipment
85	MGAL	09/26/89	Double collection	Operator
86	MGAL	09/27/89	Double collection	Operator

INTEGRATOR PROGRAMMING INSTRUCTIONS

Instructions for programming the integrators are as follows. Be sure to press **ENTER** after each key sequence.

Control Integrator

Oven Temp 90
Oven Temp Limit 405
Oven Temp ON
Oven Temp OFF
List Oven Temp
(A listing should say OvenTemp X°C Setpt 90°C Limit 405°C)
Oven Temp Initial Time 0.20
Oven Temp Initial Value 90
Oven Temp Pgrm Rate 30.00
Oven Temp Final Value 90.00
Oven Temp Final Time 4.00
Oven Temp Equil Time 1.00

Detector A ON
Signal A
Chart speed 4.00
%Offset 10
Zero
Attn 2^ 4

Run Time Annotation ON
Run Table Annotation ON
Clock Table Annotation OFF
Program Annotation OFF
Oven Temp Annotation OFF
Report Annotation OFF

Slave Integrator

Detector B ON
Signal B
Chart speed 4.00
%Offset 10
Zero
Attn 2^ 4

Run Time Annotation ON
Run Table Annotation ON
Clock Table Annotation OFF
Program Annotation OFF
Oven Temp Annotation OFF
(should say ***Warning***Oven Temp now owned by Chnl 2)
Report Annotation OFF

INTEGRATOR PROGRAMMING INSTRUCTIONS (Continued)

Control Integrator

```
Oven Temp Annotation OFF
     (should say ***Warning***Oven Temp now owned by Chnl 1)
Run Time 0.01 Intg OFF
Run Time 0.01 Valve 5 ON
Run Time 0.01 Page
Run Time 0.02 List Attn2^
Run Time 0.04 Oven Temp ON
Run Time 0.20 Valve 2 ON
Run Time 0.21 Valve 2 OFF
Run Time 0.22 Intg ON
Run Time 0.23 Set BL
Run Time 0.23 List Intg
Rum Time 1.87 Set BL
Run Time 1.88 Intg OFF
Run Time 1.89 List Intg
Run Time 1.90 Chart Spped 1.5
Run Time 3.44 Valve 2 ON
Run Time 3.45 Valve 2 OFF
Run Time 3.46 Valve 2 ON
Run Time 3.47 Valve 2 OFF
Run Time 3.48 Valve 2 ON
Run Time 3.49 Valve 2 OFF
Run Time 3.50 STOP
```

Slave Integrator

```
Run Time 0.01 Intg OFF
Run Time 0.01 Page
Run Time 0.02 List Attn2^
Run Time 0.22 Intg ON
Run Time 0.23 Set BL
Run Time 0.23 List Intg
Rum Time 1.87 Set BL
Run Time 1.88 Intg OFF
Run Time 1.89 List Intg
Run Time 1.90 Chart Spped 1.5
Run Time 3.50 STOP
```

Control Integrator

```
Det 1 Temp 250
Det 1 Temp Limit 405
Inj 1 Temp 31
Inj 1 Temp Limit 405
Aux 1 Temp 90
Aux 1 Temp Limit 405
Flow A 30
Flow A Limit 500
```

INTEGRATOR PROGRAMMING INSTRUCTIONS (Continued)

Slave Integrator

```
Flow B 30
Flow B Limit 500
```

Control Integrator

```
Valve 1 OFF
Valve 2 OFF
Valve 3 OFF
Valve 4 OFF
Valve 5 ON
Valve 6 OFF
Valve 7 OFF
Valve 8 OFF
Valve 9 OFF
Valve 10 OFF
Valve 11 OFF
Valve 12 OFF

Threshold 1
Peak Width 0.04
```

Slave Integrator

```
Threshold 1
Peak Width 0.04
```

Control Integrator

```
20 Valve 5 OFF
25 List Valve 5
30 Oven Temp Initial Value 30
35 Oven Temp OFF
40 Wait 2
60 Start
70 Oven Temp 90
80 Vale 5 ON

Sync ON
```

TABLE F-1. DAILY CALIBRATION DATA SUMMARY (CHANNEL A)

Cal Date	Julian Cal Date	Intial Zero A.C.	Final Zero A.C.	Initial Zero ppmC	Final Zero ppmC	Initial Cal Factor	Final Cal Factor	Cal Factor Drift	Cal Factor % Drift
06/05/89	156	10.900	10.900	0.003284	0.003284	0.000301	0.000301	0.000000	0.000000
06/06/89	157	10.615	10.615	0.003226	0.003226	0.000304	0.000304	0.000000	0.000000
06/07/89	158	2.935	10.930	0.000889	0.003290	0.000303	0.000301	0.000002	0.561288
06/08/89	159	14.190	6.055	0.004325	0.001844	0.000305	0.000304	0.000000	0.097962
06/09/89	160	10.275	10.000	0.003107	0.003037	0.000302	0.000304	-0.000001	-0.435600
06/12/89	163	5.070	5.070	0.001551	0.001551	0.000306	0.000306	0.000000	0.000000
06/13/89	164	3.995	6.170	0.001212	0.001878	0.000303	0.000304	-0.000001	-0.341099
06/14/89	165	5.985	9.890	0.001825	0.003049	0.000305	0.000308	-0.000003	-1.088544
06/15/89	166	4.860	4.335	0.001489	0.001333	0.000306	0.000307	-0.000001	-0.329681
06/16/89	167	9.130	9.130	0.002809	0.002809	0.000308	0.000308	0.000000	0.000000
06/19/89	170	5.070	7.480	0.001535	0.002268	0.000303	0.000303	-0.000000	-0.129774
06/20/89	171	8.210	8.875	0.002487	0.002691	0.000303	0.000303	-0.000000	-0.080692
06/21/89	172	7.725	7.725	0.002309	0.002334	0.000299	0.000302	-0.000003	-1.110452
06/22/89	173	2.275	10.215	0.000686	0.003079	0.000302	0.000301	0.000000	0.105912
06/23/89	174	6.410	6.410	0.001923	0.001923	0.000300	0.000300	0.000000	0.000000
06/26/89	177	7.850	3.765	0.002361	0.001128	0.000301	0.000300	0.000001	0.360888
06/27/89	178	4.670	4.565	0.001389	0.001388	0.000297	0.000304	-0.000007	-2.194403
06/28/89	179	4.140	4.140	0.001240	0.001240	0.000300	0.000300	0.000000	0.000000
06/29/89	180	4.560	3.090	0.001364	0.000932	0.000299	0.000302	-0.000003	-0.867026
06/30/89	181	7.510	6.325	0.002264	0.001909	0.000302	0.000302	-0.000000	-0.108887
07/03/89	184	5.380	0.000	0.001608	0.000000	0.000299	0.000298	0.000001	0.435590
07/05/89	186	6.295	4.485	0.001865	0.001317	0.000296	0.000294	0.000003	0.846345
07/06/89	187	5.250	3.910	0.001546	0.001149	0.000294	0.000294	0.000001	0.244776
07/07/89	188	4.215	6.250	0.001238	0.001838	0.000294	0.000294	-0.000000	-0.162985
07/10/89	191	5.925	5.950	0.001742	0.001759	0.000294	0.000296	-0.000002	-0.553429
07/11/89	192	7.380	7.380	0.002169	0.002193	0.000294	0.000297	-0.000003	-1.099212
07/12/89	193	4.455	0.000	0.001305	0.000000	0.000293	0.000295	-0.000002	-0.714895
07/13/89	194	3.410	3.410	0.000997	0.000997	0.000292	0.000292	0.000000	0.000000
07/14/89	195	6.090	5.655	0.001783	0.001670	0.000293	0.000295	-0.000003	-0.891716
07/17/89	198	0.000	0.000	0.000000	0.000000	0.000293	0.000291	0.000001	0.459737
07/18/89	199	4.550	4.390	0.001332	0.001286	0.000293	0.000293	0.000000	0.001611
07/19/89	200	4.685	7.490	0.001370	0.002217	0.000293	0.000296	-0.000003	-1.195837
07/20/89	201	4.250	3.590	0.001244	0.001061	0.000293	0.000296	-0.000003	-0.998934
07/21/89	202	2.950	7.275	0.000865	0.002148	0.000293	0.000295	-0.000002	-0.669453
07/24/89	205	5.275	5.225	0.001546	0.001542	0.000293	0.000295	-0.000002	-0.696826
07/25/89	206	6.325	4.930	0.001856	0.001473	0.000293	0.000299	-0.000005	-1.802933
07/26/89	207	2.800	11.280	0.000819	0.003320	0.000292	0.000294	-0.000002	-0.671883
07/27/89	208	3.660	4.245	0.001072	0.001259	0.000293	0.000297	-0.000004	-1.255266
07/28/89	209	3.430	3.430	0.001021	0.001021	0.000298	0.000298	0.000000	0.000000
07/31/89	212	3.885	3.645	0.001157	0.001090	0.000298	0.000299	-0.000001	-0.430754
08/01/89	213	4.015	7.330	0.001204	0.002196	0.000300	0.000300	0.000000	0.086014
08/02/89	214	5.575	10.705	0.001674	0.003173	0.000300	0.000296	0.000004	1.273258

TABLE F-1. DAILY CALIBRATION DATA SUMMARY (CHANNEL A)

Cal Date	Julian Cal Date	Intial Zero A.C.	Final Zero A.C.	Initial Zero ppmC	Final Zero ppmC	Initial Cal Factor	Final Cal Factor	Cal Factor Drift	Cal Factor % Drift
08/03/89	215	4.460	5.645	0.001325	0.001680	0.000297	0.000298	-0.000001	-0.188203
08/04/89	216	5.820	0.690	0.001701	0.000201	0.000292	0.000291	0.000002	0.581712
08/07/89	219	3.090	3.980	0.000898	0.001165	0.000291	0.000293	-0.000002	-0.666674
08/08/89	220	4.975	0.000	0.001444	0.000000	0.000290	0.000295	-0.000005	-1.633820
08/09/89	221	0.785	8.595	0.000230	0.002524	0.000293	0.000294	-0.000000	-0.059249
08/10/89	222	2.325	7.900	0.000680	0.002402	0.000293	0.000304	-0.000012	-3.960407
08/11/89	223	3.325	12.075	0.000972	0.003500	0.000292	0.000290	0.000003	0.875000
08/14/89	226	0.000	9.525	0.000000	0.002793	0.000291	0.000293	-0.000002	-0.698089
08/15/89	227	0.000	4.165	0.000000	0.001223	0.000291	0.000294	-0.000003	-0.957405
08/16/89	228	3.930	5.585	0.001154	0.001647	0.000294	0.000295	-0.000001	-0.395674
08/17/89	229	3.600	7.395	0.001055	0.002199	0.000293	0.000297	-0.000004	-1.474376
08/18/89	230	3.900	5.480	0.001154	0.001647	0.000296	0.000301	-0.000005	-1.541833
08/21/89	233	4.770	4.580	0.001423	0.001349	0.000298	0.000295	0.000004	1.280209
08/22/89	234	5.250	8.670	0.001533	0.002575	0.000292	0.000297	-0.000005	-1.739579
08/23/89	235	13.950	11.420	0.004193	0.003404	0.000301	0.000298	0.000002	0.828477
08/24/89	236	3.855	4.915	0.001136	0.001492	0.000295	0.000303	-0.000009	-2.989675
08/25/89	237	3.250	0.000	0.000962	0.000000	0.000296	0.000297	-0.000001	-0.464852
08/28/89	240	2.670	0.000	0.000798	0.000000	0.000299	0.000295	0.000004	1.416399
08/29/89	241	4.535	4.835	0.001325	0.001434	0.000292	0.000297	-0.000004	-1.516439
08/30/89	242	3.750	3.750	0.001118	0.001118	0.000298	0.000298	0.000000	0.000000
08/31/89	243	2.195	1.990	0.000645	0.000593	0.000294	0.000298	-0.000004	-1.501712
09/01/89	244	3.620	3.620	0.001064	0.001064	0.000294	0.000294	0.000000	0.000000
09/05/89	248	2.740	6.005	0.000808	0.001783	0.000295	0.000297	-0.000002	-0.634905
09/06/89	249	2.880	15.565	0.000853	0.004587	0.000296	0.000295	0.000001	0.495894
09/07/89	250	3.615	0.000	0.001061	0.000000	0.000294	0.000296	-0.000003	-0.931626
09/08/89	251	4.350	4.350	0.001287	0.001287	0.000296	0.000296	0.000000	0.000000
09/11/89	254	5.050	5.050	0.001485	0.001485	0.000294	0.000294	0.000000	0.000000
09/12/89	255	4.770	3.965	0.001394	0.001170	0.000292	0.000295	-0.000003	-0.981665
09/13/89	256	4.880	4.775	0.001431	0.001407	0.000293	0.000295	-0.000001	-0.475028
09/14/89	257	3.700	3.700	0.001084	0.001084	0.000293	0.000293	0.000000	0.000000
09/15/89	258	2.675	5.630	0.000785	0.001645	0.000293	0.000292	0.000001	0.437559
09/18/89	261	2.150	0.000	0.000624	0.000000	0.000290	0.000292	-0.000002	-0.687442
09/19/89	262	3.620	5.835	0.001048	0.001694	0.000290	0.000290	-0.000001	-0.279998
09/20/89	263	5.835	3.345	0.001694	0.000968	0.000290	0.000289	0.000001	0.381854
09/21/89	264	4.135	0.000	0.001192	0.000000	0.000288	0.000292	-0.000004	-1.402463
09/22/89	265	3.440	3.440	0.000990	0.000990	0.000288	0.000288	0.000000	0.000000
09/25/89	268	4.205	4.205	0.001208	0.001208	0.000287	0.000287	0.000000	0.000000
09/26/89	269	3.530	3.530	0.001022	0.001022	0.000290	0.000290	0.000000	0.000000
09/27/89	270	2.520	0.000	0.000734	0.000000	0.000291	0.000295	-0.000003	-1.165454
09/28/89	271	4.890	4.890	0.001415	0.001415	0.000289	0.000289	0.000000	0.000000
09/29/89	272	3.475	3.475	0.001010	0.001010	0.000291	0.000291	0.000000	0.000000
10/02/89	275	3.795	3.795	0.001092	0.001092	0.000288	0.000288	0.000000	0.000000

TABLE F-1. DAILY CALIBRATION DATA SUMMARY (CHANNEL A)

Cal Date	Julian Cal Date	Intial Zero A.C.	Final Zero A.C.	Initial Zero ppmC	Final Zero ppmC	Initial Cal Factor	Final Cal Factor	Cal Factor Drift	Cal Factor % Drift
10/03/89	276	3.490	0.000	0.001011	0.000000	0.000290	0.000291	-0.000002	-0.595562
10/04/89	277	2.360	2.360	0.000680	0.000680	0.000288	0.000288	0.000000	0.000000

TABLE F-2. DAILY CALIBRATION DATA SUMMARY (CHANNEL B)

Cal Date	Julian Cal Date	Intial Zero A.C.	Final Zero A.C.	Initial Zero ppmC	Final Zero ppmC	Initial Cal Factor	Final Cal Factor	Cal Factor Drift	Cal Factor % Drift
06/05/89	156	0.000	0.000	0.000000	0.000000	0.000305	0.000305	0.000000	0.000000
06/06/89	157	0.000	0.000	0.000000	0.000000	0.000305	0.000305	0.000000	0.000000
06/07/89	158	0.000	1.480	0.000000	0.000452	0.000305	0.000305	-0.000000	-0.032930
06/08/89	159	0.000	0.000	0.000000	0.000000	0.000310	0.000311	-0.000001	-0.267073
06/09/89	160	0.525	0.000	0.000162	0.000000	0.000308	0.000308	0.000000	0.005440
06/12/89	163	1.540	1.540	0.000477	0.000477	0.000309	0.000309	0.000000	0.000000
06/13/89	164	0.000	0.000	0.000000	0.000000	0.000309	0.000310	-0.000002	-0.587934
06/14/89	165	0.000	0.000	0.000000	0.000000	0.000311	0.000309	0.000001	0.467012
06/15/89	166	0.000	0.000	0.000000	0.000000	0.000309	0.000310	-0.000001	-0.202326
06/16/89	167	0.000	0.000	0.000000	0.000000	0.000311	0.000311	0.000000	0.000000
06/19/89	170	0.000	0.000	0.000188	0.000000	0.000313	0.000312	0.000001	0.409948
06/20/89	171	0.865	2.175	0.000270	0.000681	0.000313	0.000313	-0.000001	-0.249473
06/21/89	172	0.315	0.315	0.000097	0.000098	0.000309	0.000312	-0.000003	-1.066989
06/22/89	173	2.800	5.910	0.000000	0.001837	0.000310	0.000311	-0.000000	-0.114349
06/23/89	174	1.285	1.285	0.000397	0.000397	0.000309	0.000309	0.000000	0.000000
06/26/89	177	0.120	0.000	0.000037	0.000000	0.000308	0.000310	-0.000002	-0.681143
06/27/89	178	0.000	0.000	0.000000	0.000000	0.000309	0.000314	-0.000005	-1.520471
06/28/89	179	0.000	0.000	0.000000	0.000000	0.000309	0.000309	0.000000	0.000000
06/29/89	180	0.000	0.000	0.000000	0.000000	0.000309	0.000311	-0.000002	-0.686530
06/30/89	181	8.245	7.635	0.001848	0.002377	0.000310	0.000311	-0.000001	-0.420167
07/03/89	184	1.775	0.000	0.000546	0.000000	0.000307	0.000308	-0.000000	-0.146081
07/05/89	186	0.000	0.000	0.000000	0.000000	0.000307	0.000304	0.000003	0.888594
07/06/89	187	0.000	0.000	0.000000	0.000000	0.000304	0.000302	0.000002	0.597033
07/07/89	188	0.000	0.000	0.000000	0.000000	0.000305	0.000304	0.000000	0.052633
07/10/89	191	2.875	5.750	0.000000	0.001747	0.000304	0.000304	0.000000	0.059573
07/11/89	192	0.000	0.000	0.000000	0.000000	0.000305	0.000308	-0.000003	-0.828714
07/12/89	193	0.450	0.000	0.000137	0.000000	0.000305	0.000307	-0.000002	-0.726438
07/13/89	194	1.630	1.630	0.000497	0.000497	0.000305	0.000305	0.000000	0.000000
07/14/89	195	0.000	0.000	0.000000	0.000000	0.000302	0.000303	-0.000001	-0.454025
07/17/89	198	1.520	0.000	0.000932	0.000000	0.000303	0.000305	-0.000002	-0.770036
07/18/89	199	0.000	0.000	0.000000	0.000000	0.000303	0.000303	0.000000	0.000000
07/19/89	200	1.820	3.235	0.000553	0.000987	0.000304	0.000305	-0.000002	-0.526010
07/20/89	201	0.000	1.890	0.000000	0.000579	0.000303	0.000306	-0.000003	-0.895876
07/21/89	202	1.310	1.515	0.000398	0.000464	0.000304	0.000307	-0.000003	-0.996205
07/24/89	205	0.940	2.375	0.000288	0.000725	0.000306	0.000305	0.000001	0.226881
07/25/89	206	0.000	0.000	0.000000	0.000000	0.000305	0.000307	-0.000002	-0.516808
07/26/89	207	0.000	0.000	0.000000	0.000000	0.000303	0.000306	-0.000003	-1.023768
07/27/89	208	0.935	0.000	0.000285	0.000000	0.000304	0.000307	-0.000003	-0.831039
07/28/89	209	1.025	1.025	0.000316	0.000316	0.000308	0.000308	0.000000	0.000000
07/31/89	212	0.000	0.000	0.000000	0.000000	0.000307	0.000309	-0.000002	-0.594243
08/01/89	213	1.365	3.160	0.000420	0.000973	0.000307	0.000308	-0.000001	-0.176448
08/02/89	214	0.000	2.675	0.000000	0.000827	0.000309	0.000309	-0.000000	-0.060981

TABLE F-2. DAILY CALIBRATION DATA SUMMARY (CHANNEL B)

Cal Date	Julian Cal Date	Intial Zero A.C.	Final Zero A.C.	Initial Zero ppmC	Final Zero ppmC	Initial Cal Factor	Final Cal Factor	Cal Factor Drift	Cal Factor % Drift
08/03/89	215	0.000	0.000	0.000000	0.000000	0.000308	0.000309	-0.000001	-0.220733
08/04/89	216	0.000	0.000	0.000000	0.000000	0.000305	0.000302	0.000003	0.925512
08/07/89	219	0.000	2.735	0.000000	0.000830	0.000301	0.000303	-0.000003	-0.883351
08/08/89	220	1.640	1.640	0.000000	0.000498	0.000299	0.000304	-0.000005	-1.553606
08/09/89	221	0.000	0.000	0.000000	0.000000	0.000301	0.000304	-0.000003	-1.011834
08/10/89	222	0.375	0.000	0.000113	0.000000	0.000301	0.000302	-0.000001	-0.327116
08/11/89	223	0.910	2.440	0.000000	0.000734	0.000301	0.000301	0.000000	0.102413
08/14/89	226	0.000	0.000	0.000000	0.000000	0.000302	0.000303	-0.000002	-0.646297
08/15/89	227	0.000	0.000	0.000000	0.000000	0.000301	0.000306	-0.000005	-1.596068
08/16/89	228	0.000	0.000	0.000000	0.000000	0.000301	0.000302	-0.000001	-0.365781
08/17/89	229	0.905	4.405	0.000000	0.001328	0.000302	0.000302	0.000001	0.231768
08/18/89	230	0.000	0.000	0.000000	0.000000	0.000298	0.000297	0.000001	0.330627
08/21/89	233	0.000	2.225	0.000000	0.000686	0.000304	0.000308	-0.000004	-1.447874
08/22/89	234	0.625	1.855	0.000190	0.000571	0.000303	0.000308	-0.000005	-1.499200
08/23/89	235	3.055	5.540	0.000424	0.001695	0.000304	0.000306	-0.000002	-0.695325
08/24/89	236	0.000	0.000	0.000000	0.000000	0.000303	0.000314	-0.000011	-3.600472
08/25/89	237	0.000	0.595	0.000000	0.000183	0.000310	0.000308	0.000001	0.408081
08/28/89	240	0.585	0.000	0.000604	0.000000	0.000304	0.000308	-0.000004	-1.190001
08/29/89	241	0.000	2.030	0.000000	0.000619	0.000305	0.000305	-0.000000	-0.061877
08/30/89	242	0.000	0.000	0.000000	0.000000	0.000304	0.000304	0.000000	0.000000
08/31/89	243	0.000	0.000	0.000000	0.000000	0.000304	0.000303	0.000001	0.213428
09/01/89	244	0.000	0.000	0.000000	0.000000	0.000303	0.000303	0.000000	0.000000
09/05/89	248	0.000	2.000	0.000000	0.000612	0.000305	0.000306	-0.000001	-0.320421
09/06/89	249	0.000	2.530	0.000000	0.000779	0.000304	0.000308	-0.000004	-1.166536
09/07/89	250	0.000	0.000	0.000000	0.000000	0.000304	0.000304	-0.000000	-0.031004
09/08/89	251	0.870	0.870	0.000264	0.000264	0.000304	0.000304	0.000000	0.000000
09/11/89	254	0.000	0.000	0.000000	0.000000	0.000304	0.000304	0.000000	0.000000
09/12/89	255	0.000	0.000	0.000000	0.000000	0.000304	0.000306	-0.000002	-0.648759
09/13/89	256	3.825	5.335	0.000000	0.001624	0.000303	0.000304	-0.000001	-0.384231
09/14/89	257	0.000	0.000	0.000000	0.000000	0.000303	0.000303	0.000000	0.000000
09/15/89	258	0.000	0.905	0.000000	0.000277	0.000303	0.000306	-0.000003	-1.078605
09/18/89	261	0.000	0.000	0.000000	0.000000	0.000299	0.000299	0.000000	0.099762
09/19/89	262	0.000	0.000	0.000000	0.000000	0.000299	0.000298	0.000002	0.503915
09/20/89	263	0.000	0.000	0.000000	0.000000	0.000298	0.000301	-0.000003	-1.115485
09/21/89	264	0.000	0.000	0.000000	0.000000	0.000299	0.000300	-0.000001	-0.302059
09/22/89	265	0.000	0.000	0.000000	0.000000	0.000299	0.000299	0.000000	0.000000
09/25/89	268	0.000	0.000	0.000000	0.000000	0.000298	0.000298	0.000000	0.000000
09/26/89	269	0.000	0.000	0.000000	0.000000	0.000301	0.000301	0.000000	0.000000
09/27/89	270	0.000	0.000	0.000000	0.000000	0.000304	0.000303	0.000001	0.294636
09/28/89	271	0.000	0.000	0.000000	0.000000	0.000300	0.000300	0.000000	0.000000
09/23/89	272	0.000	0.000	0.000000	0.000000	0.000300	0.000300	0.000000	0.000000
10/02/89	275	0.000	0.000	0.000000	0.000000	0.000297	0.000297	0.000000	0.000000

TABLE F-2. DAILY CALIBRATION DATA SUMMARY (CHANNEL B)

Cal Date	Julian Cal Date	Intial Zero A.C.	Final Zero A.C.	Initial Zero ppmC	Final Zero ppmC	Initial Cal Factor	Final Cal Factor	Cal Factor Drift	Cal Factor % Drift
10/03/89	276	0.000	0.000	0.000000	0.000000	0.000297	0.000301	-0.000004	-1.253519
10/04/89	277	0.000	0.000	0.000000	0.000000	0.000299	0.000299	0.000000	0.000000

TABLE F-3. DAILY CALIBRATION DATA SUMMARY (CHANNEL C)

Cal Date	Julian Cal Date	Intial Zero A.C.	Final Zero A.C.	Initial Zero ppmC	Final Zero ppmC	Initial Cal Factor	Final Cal Factor	Cal Factor Drift	Cal Factor % Drift
06/05/89	156	0.000	0.000	0.000000	0.000000	0.000307	0.000307	0.000000	0.000000
06/06/89	157	0.000	0.000	0.000000	0.000000	0.000303	0.000303	0.000000	0.000000
06/07/89	158	0.925	0.000	0.000287	0.000000	0.000310	0.000306	0.000004	1.162502
06/08/89	159	0.000	0.865	0.000000	0.000267	0.000305	0.000309	-0.000005	-1.523787
06/09/89	160	0.000	0.000	0.000000	0.000000	0.000309	0.000308	0.000000	0.112705
06/12/89	163	6.510	6.510	0.002016	0.002016	0.000310	0.000310	0.000000	0.000000
06/13/89	164	0.000	0.000	0.000000	0.000000	0.000309	0.000309	-0.000000	-0.108095
06/14/89	165	2.075	0.000	0.000643	0.000000	0.000310	0.000311	-0.000001	-0.300575
06/15/89	166	0.000	0.000	0.000000	0.000000	0.000309	0.000313	-0.000004	-1.397509
06/16/89	167	0.000	0.000	0.000000	0.000000	0.000309	0.000309	0.000000	0.000000
06/19/89	170	0.720	0.000	0.000224	0.000000	0.000311	0.000311	0.000001	0.227065
06/20/89	171	0.000	4.880	0.000000	0.001519	0.000311	0.000311	-0.000001	-0.210027
06/21/89	172	0.000	0.000	0.000000	0.000000	0.000311	0.000311	-0.000000	-0.003374
06/22/89	173	0.000	1.765	0.000000	0.000549	0.000311	0.000311	0.000000	0.014707
06/23/89	174	0.000	0.000	0.000000	0.000000	0.000311	0.000311	0.000000	0.000000
06/26/89	177	1.880	0.000	0.000581	0.000000	0.000309	0.000311	-0.000002	-0.666836
06/27/89	178	0.000	0.000	0.000000	0.000000	0.000307	0.000309	-0.000001	-0.470070
06/28/89	179	7.075	7.075	0.002196	0.002196	0.000310	0.000310	0.000000	0.000000
06/29/89	180	1.855	3.505	0.000573	0.001093	0.000309	0.000312	-0.000003	-1.009925
06/30/89	181	10.560	0.000	0.003310	0.000000	0.000313	0.000315	-0.000001	-0.360721
07/03/89	184	0.310	0.000	0.000096	0.000000	0.000311	0.000309	0.000002	0.620594
07/05/89	186	3.495	4.735	0.001076	0.001456	0.000308	0.000307	0.000000	0.137097
07/06/89	187	0.380	0.000	0.000117	0.000000	0.000307	0.000307	-0.000000	-0.037251
07/07/89	188	1.315	0.340	0.000400	0.000104	0.000304	0.000306	-0.000002	-0.593701
07/10/89	191	0.000	8.300	0.000000	0.002556	0.000305	0.000308	-0.000003	-0.922116
07/11/89	192	0.000	0.000	0.000000	0.000000	0.000307	0.000306	0.000001	0.226307
07/12/89	193	0.730	0.000	0.000222	0.000000	0.000304	0.000306	-0.000002	-0.614882
07/13/89	194	0.000	0.000	0.000000	0.000000	0.000303	0.000303	0.000000	0.000000
07/14/89	195	0.000	0.855	0.000000	0.000262	0.000305	0.000306	-0.000001	-0.459346
07/17/89	198	1.225	4.970	0.000372	0.001526	0.000304	0.000307	-0.000003	-1.127941
07/18/89	199	0.000	0.000	0.000000	0.000000	0.000301	0.000301	0.000000	0.000000
07/19/89	200	0.000	0.000	0.000000	0.000000	0.000306	0.000306	-0.000000	-0.002155
07/20/89	201	0.000	0.000	0.000000	0.000000	0.000306	0.000307	-0.000001	-0.258112
07/21/89	202	1.235	0.000	0.000377	0.000000	0.000305	0.000307	-0.000002	-0.705133
07/24/89	205	0.950	3.830	0.000288	0.001166	0.000303	0.000305	-0.000001	-0.400412
07/25/89	206	0.865	3.895	0.000265	0.001192	0.000307	0.000306	0.000001	0.214445
07/26/89	207	1.395	4.095	0.000426	0.001256	0.000305	0.000307	-0.000001	-0.488261
07/27/89	208	0.000	2.250	0.000000	0.000682	0.000305	0.000303	0.000002	0.641400
07/28/89	209	0.000	0.000	0.000000	0.000000	0.000310	0.000310	0.000000	0.002075
07/31/89	212	0.000	0.000	0.000000	0.000000	0.000310	0.000311	-0.000001	-0.455049
08/01/89	213	0.000	1.420	0.000000	0.000436	0.000310	0.000307	0.000003	0.889591
08/02/89	214	0.000	0.000	0.000000	0.000000	0.000310	0.000312	-0.000002	-0.720842

TABLE F-3. DAILY CALIBRATION DATA SUMMARY (CHANNEL C)

Cal Date	Julian Cal Date	Intial Zero A.C.	Final Zero A.C.	Initial Zero ppmC	Final Zero ppmC	Initial Cal Factor	Final Cal Factor	Cal Factor Drift	Cal Factor % Drift
08/03/89	215	0.000	0.000	0.000000	0.000000	0.000310	0.000311	-0.000001	-0.476143
08/04/89	216	0.000	8.880	0.000000	0.002743	0.000303	0.000309	-0.000006	-1.975971
08/06/89	218	0.000	0.000	0.000000	0.000000	0.000301	0.000301	0.000000	0.000000
08/07/89	219	0.000	0.565	0.000000	0.000172	0.000304	0.000304	0.000000	0.116014
08/08/89	220	0.000	2.260	0.000000	0.000691	0.000302	0.000306	-0.000004	-1.403917
08/09/89	221	0.000	0.000	0.000000	0.000000	0.000306	0.000307	-0.000001	-0.282915
08/10/89	222	0.000	0.000	0.000000	0.000000	0.000303	0.000299	0.000004	1.279521
08/11/89	223	0.000	0.000	0.000000	0.000000	0.000302	0.000303	-0.000001	-0.337705
08/14/89	226	0.000	2.860	0.000000	0.000875	0.000302	0.000306	-0.000003	-1.106086
08/15/89	227	0.000	1.040	0.000000	0.000316	0.000302	0.000304	-0.000002	-0.753107
08/16/89	228	0.000	0.000	0.000000	0.000000	0.000303	0.000302	0.000001	0.373168
08/17/89	229	0.000	5.655	0.000000	0.001721	0.000303	0.000304	-0.000001	-0.406379
08/18/89	230	0.395	0.295	0.000117	0.000091	0.000295	0.000308	-0.000013	-4.541017
08/21/89	233	0.000	0.000	0.000000	0.000000	0.000306	0.000312	-0.000006	-1.886510
08/22/89	234	0.000	0.000	0.000000	0.000000	0.000311	0.000315	-0.000005	-1.467086
08/23/89	235	3.885	1.075	0.001187	0.000335	0.000306	0.000312	-0.000006	-1.981042
08/24/89	236	0.000	0.000	0.000000	0.000000	0.000311	0.000322	-0.000011	-3.505237
08/25/89	237	0.000	5.750	0.000000	0.001823	0.000307	0.000317	-0.000010	-3.373133
08/28/89	240	0.605	0.000	0.000187	0.000000	0.000309	0.000310	-0.000001	-0.208303
08/29/89	241	0.000	0.000	0.000000	0.000000	0.000307	0.000304	0.000003	1.016790
08/30/89	242	3.445	3.445	0.001056	0.001056	0.000306	0.000306	0.000000	0.000000
08/31/89	243	0.000	0.000	0.000000	0.000000	0.000305	0.000311	-0.000006	-2.105117
09/01/89	244	0.000	0.000	0.000000	0.000000	0.000307	0.000307	0.000000	0.000000
09/05/89	248	0.000	17.805	0.000000	0.005563	0.000308	0.000312	-0.000005	-1.505648
09/06/89	249	0.000	0.855	0.000000	0.000266	0.000303	0.000311	-0.000008	-2.778766
09/07/89	250	0.000	0.000	0.000000	0.000000	0.000307	0.000308	-0.000000	-0.022856
09/08/89	251	0.000	0.000	0.000000	0.000000	0.000307	0.000307	0.000000	0.000000
09/11/89	254	0.000	0.000	0.000000	0.000000	0.000304	0.000304	0.000000	0.000000
09/12/89	255	0.000	0.000	0.000000	0.000000	0.000307	0.000307	0.000000	0.055230
09/13/89	256	0.000	0.000	0.000000	0.000000	0.000303	0.000304	-0.000001	-0.364337
09/14/89	257	0.000	0.000	0.000000	0.000000	0.000303	0.000303	0.000000	0.000000
09/15/89	258	0.000	1.315	0.000000	0.000400	0.000305	0.000304	0.000001	0.202849
09/18/89	261	0.000	0.000	0.000000	0.000000	0.000299	0.000305	-0.000005	-1.751838
09/19/89	262	0.000	0.000	0.000000	0.000000	0.000302	0.000301	0.000001	0.434796
09/20/89	263	0.000	0.000	0.000000	0.000000	0.000301	0.000302	-0.000001	-0.397107
09/21/89	264	0.000	0.000	0.000000	0.000000	0.000301	0.000300	0.000001	0.410038
09/22/89	265	0.000	0.000	0.000000	0.000000	0.000300	0.000300	0.000000	0.000000
09/24/89	267	0.000	0.000	0.000000	0.000000	0.000299	0.000299	0.000000	0.000000
09/25/89	268	0.000	0.000	0.000000	0.000000	0.000298	0.000298	0.000000	0.000000
09/26/89	269	0.000	0.000	0.000000	0.000000	0.000301	0.000301	0.000000	0.000000
09/27/89	270	0.000	0.000	0.000000	0.000000	0.000302	0.000305	-0.000002	-0.807703
09/28/89	271	0.000	0.000	0.000000	0.000000	0.000300	0.000300	0.000000	0.000000

TABLE F-3. DAILY CALIBRATION DATA SUMMARY (CHANNEL C)

Cal Date	Julian Cal Date	Intial Zero A.C.	Final Zero A.C.	Initial Zero ppmC	Final Zero ppmC	Initial Cal Factor	Final Cal Factor	Cal Factor Drift	Cal Factor % Drift
09/29/89	272	0.000	0.000	0.000000	0.000000	0.000302	0.000302	0.000000	0.000000
10/02/89	275	0.000	0.000	0.000000	0.000000	0.000299	0.000299	0.000000	0.000000
10/03/89	276	0.000	0.000	0.000000	0.000000	0.000301	0.000302	-0.000002	-0.534528
10/04/89	277	0.000	0.000	0.000000	0.000000	0.000300	0.000300	0.000000	0.000000

TABLE F-4. DAILY CALIBRATION DATA SUMMARY (CHANNEL D)

Cal Date	Julian Cal Date	Intial Zero A.C.	Final Zero A.C.	Initial Zero ppmC	Final Zero ppmC	Initial Cal Factor	Final Cal Factor	Cal Factor Drift	Cal Factor % Drift
06/05/89	156	0.000	0.000	0.000000	0.000000	0.000304	0.000304	0.000000	0.000000
06/06/89	157	0.000	0.000	0.000000	0.000000	0.000299	0.000299	0.000000	0.000000
06/07/89	158	4.395	0.000	0.001374	0.000000	0.000313	0.000302	0.000010	3.350653
06/08/89	159	0.000	0.000	0.000000	0.000000	0.000304	0.000304	0.000001	0.272276
06/09/89	160	0.000	0.450	0.000000	0.000135	0.000302	0.000300	0.000002	0.671377
06/12/89	163	7.320	7.320	0.002253	0.002253	0.000308	0.000308	0.000000	0.000000
06/13/89	164	4.375	0.000	0.001342	0.000000	0.000307	0.000311	-0.000005	-1.509456
06/14/89	165	0.000	0.000	0.000000	0.000000	0.000307	0.000308	-0.000001	-0.294841
06/15/89	166	0.000	0.460	0.000000	0.000149	0.000307	0.000310	-0.000003	-0.942282
06/16/89	167	0.000	0.000	0.000000	0.000000	0.000306	0.000306	0.000000	0.000000
06/19/89	170	0.000	0.000	0.000000	0.000000	0.000310	0.000309	0.000000	0.111115
06/20/89	171	2.995	2.480	0.000920	0.000763	0.000307	0.000307	-0.000000	-0.149677
06/21/89	172	0.000	0.000	0.000000	0.000000	0.000305	0.000309	-0.000004	-1.298378
06/22/89	173	0.000	2.015	0.000000	0.000618	0.000307	0.000307	0.000000	0.136536
06/23/89	174	0.000	0.000	0.000000	0.000000	0.000308	0.000308	0.000000	0.000000
06/26/89	177	0.000	0.000	0.000000	0.000000	0.000308	0.000307	0.000001	0.196775
06/27/89	178	0.000	0.000	0.000000	0.000000	0.000301	0.000296	0.000005	1.782288
06/28/89	179	6.840	6.840	0.002105	0.002105	0.000308	0.000308	0.000000	0.000000
06/29/89	180	0.035	1.175	0.000011	0.000363	0.000306	0.000309	-0.000003	-1.003048
06/30/89	181	0.710	1.715	0.000220	0.000533	0.000310	0.000310	-0.000001	-0.310233
07/03/89	184	0.000	0.000	0.000000	0.000000	0.000306	0.000305	0.000001	0.307133
07/05/89	186	2.255	5.075	0.000689	0.001542	0.000305	0.000304	0.000002	0.540610
07/06/89	187	5.350	7.640	0.001627	0.002320	0.000304	0.000304	0.000000	0.131631
07/07/89	188	0.000	2.235	0.000000	0.000676	0.000302	0.000302	-0.000001	-0.271935
07/10/89	191	0.000	0.000	0.000000	0.000000	0.000302	0.000304	-0.000002	-0.638951
07/11/89	192	0.000	0.000	0.000000	0.000000	0.000303	0.000303	0.000001	0.195601
07/12/89	193	0.000	0.000	0.000000	0.000000	0.000302	0.000303	-0.000001	-0.416619
07/13/89	194	0.220	0.220	0.000066	0.000066	0.000300	0.000300	0.000000	0.000000
07/14/89	195	0.000	0.000	0.000000	0.000000	0.000303	0.000303	0.000000	0.113669
07/17/89	198	0.540	4.695	0.000163	0.001426	0.000302	0.000304	-0.000001	-0.475004
07/18/89	199	0.000	0.000	0.000000	0.000000	0.000302	0.000302	0.000000	0.000000
07/19/89	200	7.030	1.535	0.002123	0.000462	0.000302	0.000301	0.000001	0.216507
07/20/89	201	0.000	0.115	0.000000	0.000035	0.000301	0.000302	-0.000000	-0.144582
07/21/89	202	0.000	3.890	0.000000	0.001186	0.000301	0.000305	-0.000004	-1.201915
07/24/89	205	0.000	6.175	0.000000	0.001895	0.000305	0.000307	-0.000001	-0.441588
07/25/89	206	0.000	4.885	0.000000	0.001479	0.000303	0.000303	0.000000	0.083444
07/26/89	207	4.515	2.670	0.001357	0.000812	0.000301	0.000304	-0.000003	-1.164375
07/27/89	208	0.000	6.160	0.000000	0.001852	0.000301	0.000301	0.000001	0.277864
07/28/89	209	0.000	0.000	0.000000	0.000000	0.000307	0.000307	0.000000	0.000000
07/31/89	212	0.000	0.000	0.000000	0.000000	0.000307	0.000310	-0.000003	-0.901830
08/01/89	213	0.000	3.620	0.000000	0.001132	0.000306	0.000313	-0.000006	-1.993076
08/02/89	214	5.865	0.000	0.001788	0.000000	0.000305	0.000307	-0.000002	-0.657493

TABLE F-4. DAILY CALIBRATION DATA SUMMARY (CHANNEL D)

Cal Date	Julian Cal Date	Intial Zero A.C.	Final Zero A.C.	Initial Zero ppmC	Final Zero ppmC	Initial Cal Factor	Final Cal Factor	Cal Factor Drift	Cal Factor % Drift
08/03/89	215	0.000	0.000	0.000000	0.000000	0.000307	0.000308	-0.000001	-0.358708
08/04/89	216	0.000	3.050	0.000000	0.000925	0.000300	0.000303	-0.000004	-1.208061
08/06/89	218	0.000	0.000	0.000000	0.000000	0.000299	0.000299	0.000000	0.000000
08/07/89	219	0.000	0.000	0.000000	0.000000	0.000300	0.000300	0.000000	0.029398
08/08/89	220	0.000	2.315	0.000000	0.000697	0.000299	0.000301	-0.000002	-0.616333
08/09/89	221	0.000	0.000	0.000000	0.000000	0.000301	0.000302	-0.000001	-0.336481
08/10/89	222	0.000	0.000	0.000000	0.000000	0.000300	0.000303	-0.000003	-1.107990
08/11/89	223	2.465	0.000	0.000739	0.000000	0.000300	0.000300	-0.000000	-0.144798
08/14/89	226	0.000	0.000	0.000000	0.000000	0.000300	0.000306	-0.000006	-1.855203
08/15/89	227	0.000	3.710	0.000000	0.001132	0.000299	0.000305	-0.000006	-1.921009
08/16/89	228	0.000	0.000	0.000000	0.000000	0.000299	0.000302	-0.000002	-0.779748
08/17/89	229	0.000	4.565	0.000000	0.001370	0.000300	0.000300	-0.000000	-0.003137
08/18/89	230	0.000	0.000	0.000000	0.000000	0.000306	0.000292	0.000014	4.460500
08/21/89	233	0.000	0.000	0.000000	0.000000	0.000294	0.000298	-0.000004	-1.423636
08/22/89	234	0.000	0.000	0.000000	0.000000	0.000299	0.000306	-0.000007	-2.272854
08/23/89	235	0.000	0.575	0.000000	0.000174	0.000297	0.000302	-0.000004	-1.498292
08/24/89	236	0.000	0.000	0.000000	0.000000	0.000303	0.000309	-0.000006	-2.056354
08/25/89	237	0.000	0.000	0.000000	0.000000	0.000305	0.000312	-0.000006	-2.074276
08/28/89	240	1.780	0.000	0.000538	0.000000	0.000302	0.000304	-0.000002	-0.588713
08/29/89	241	0.000	8.890	0.000000	0.002642	0.000303	0.000297	0.000005	1.816768
08/30/89	242	12.730	12.730	0.003872	0.003872	0.000304	0.000304	0.000000	0.000000
08/31/89	243	0.000	0.000	0.000000	0.000000	0.000302	0.000308	-0.000006	-1.993487
09/01/89	244	0.360	0.360	0.000109	0.000109	0.000303	0.000303	0.000000	0.000000
09/05/89	248	0.000	2.140	0.000000	0.000665	0.000304	0.000311	-0.000007	-2.357163
09/06/89	249	0.000	0.375	0.000000	0.000116	0.000303	0.000310	-0.000006	-2.121072
09/07/89	250	0.000	0.000	0.000000	0.000000	0.000303	0.000304	-0.000001	-0.327210
09/08/89	251	0.000	0.000	0.000000	0.000000	0.000304	0.000304	0.000000	0.000000
09/11/89	254	0.000	0.000	0.000000	0.000000	0.000302	0.000302	0.000000	0.000000
09/12/89	255	0.000	0.000	0.000000	0.000000	0.000303	0.000303	-0.000001	-0.205518
09/13/89	256	0.000	0.000	0.000000	0.000000	0.000309	0.000309	0.000000	0.023649
09/14/89	257	2.350	2.350	0.000709	0.000709	0.000302	0.000302	0.000000	0.000000
09/15/89	258	0.000	0.000	0.000000	0.000000	0.000303	0.000303	-0.000001	-0.185613
09/18/89	261	0.000	0.000	0.000000	0.000000	0.000299	0.000302	-0.000003	-1.101487
09/19/89	262	0.000	0.000	0.000000	0.000000	0.000300	0.000298	0.000002	0.784490
09/20/89	263	0.000	0.000	0.000000	0.000000	0.000298	0.000301	-0.000003	-1.012285
09/21/89	264	0.000	0.000	0.000000	0.000000	0.000298	0.000297	0.000000	0.154848
09/22/89	265	0.000	0.000	0.000000	0.000000	0.000297	0.000297	0.000000	0.000000
09/24/89	267	0.000	0.000	0.000000	0.000000	0.000297	0.000297	0.000000	0.000000
09/25/89	268	0.000	0.000	0.000000	0.000000	0.000296	0.000296	0.000000	0.000000
09/26/89	269	0.000	0.000	0.000000	0.000000	0.000299	0.000299	0.000000	0.000000
09/27/89	270	0.000	0.000	0.000000	0.000000	0.000300	0.000303	-0.000004	-1.190461
09/28/89	271	0.000	0.000	0.000000	0.000000	0.000297	0.000297	0.000000	0.000000

TABLE F-4. DAILY CALIBRATION DATA SUMMARY (CHANNEL D)

Cal Date	Julian Cal Date	Intial Zero A.C.	Final Zero A.C.	Initial Zero ppmC	Final Zero ppmC	Initial Cal Factor	Final Cal Factor	Cal Factor Drift	Cal Factor % Drift
09/29/89	272	0.000	0.000	0.000000	0.000000	0.000299	0.000299	0.000000	0.000000
10/02/89	275	0.000	0.000	0.000000	0.000000	0.000297	0.000297	0.000000	0.000000
10/03/89	276	0.000	0.000	0.000000	0.000000	0.000296	0.000299	-0.000003	-0.970956
10/04/89	277	0.000	0.000	0.000000	0.000000	0.000296	0.000296	0.000000	0.000000

TABLE G-1. NMOC INHOUSE QUALITY CONTROL SAMPLES (CHANNEL A)

Date Analyzed	Julian Date Analyzed	QC I.D. Number	Calculated NMOC ppmC	Measured NMOC ppmC	NMOC Bias ppmC	NMOC Percent Bias
06/06/89	157	1002	0.455	0.458	0.003	0.659
06/07/89	158	1003	0.545	0.546	0.001	0.257
06/08/89	159	1004	0.766	0.754	-0.012	-1.567
06/09/89	160	1058	0.406	0.364	-0.042	-10.345
06/12/89	163	1086	0.464	0.466	0.002	0.431
06/14/89	165	1111	0.597	0.649	0.052	8.710
06/21/89	172	1233	1.815	1.784	-0.031	-1.708
06/23/89	174	1298	0.512	0.486	-0.026	-5.078
06/26/89	177	1297	0.158	0.147	-0.011	-6.962
06/28/89	179	1354	0.284	0.292	0.008	2.817
06/29/89	180	1373	0.394	0.433	0.039	9.898
06/30/89	181	1418	0.325	0.304	-0.021	-6.462
07/03/89	184	1447	17.557	17.251	-0.306	-1.743
07/06/89	187	1471	16.763	17.557	0.794	4.737
07/10/89	191	1573	8.767	8.401	-0.366	-4.175
07/12/89	193	1599	8.395	8.767	0.372	4.431
07/14/89	195	1654	5.459	5.682	0.223	4.085
07/17/89	198	1682	1.231	1.298	0.067	5.443
07/18/89	199	1708	0.757	0.772	0.015	1.982
07/19/89	200	1734	0.478	0.490	0.012	2.510
07/20/89	201	1762	0.320	0.333	0.013	4.063
07/21/89	202	1788	0.260	0.252	-0.008	-3.077
07/24/89	205	1813	0.207	0.217	0.010	4.831
07/26/89	207	1866	0.242	0.245	0.003	1.240
07/27/89	208	1600	8.767	8.431	-0.336	-3.833
07/28/89	209	1912	0.193	0.196	0.003	1.554
07/31/89	212	1939	0.151	0.171	0.020	13.245
08/02/89	214	1988	0.132	0.126	-0.006	-4.545
08/04/89	216	2039	0.291	0.275	-0.016	-5.498
08/07/89	219	2064	0.491	0.504	0.013	2.648
08/09/89	221	2096	0.271	0.255	-0.016	-5.904
08/10/89	222	2143	0.345	0.342	-0.003	-0.870
08/11/89	223	2168	0.612	0.612	0.000	0.000
08/14/89	226	2190	0.117	0.110	-0.007	-5.983
08/15/89	227	2222	1.144	1.095	-0.049	-4.283
08/21/89	233	2318	0.701	0.667	-0.034	-4.850
08/23/89	235	2369	0.998	0.984	-0.014	-1.403
08/25/89	237	2422	3.744	3.847	0.103	2.751
08/28/89	240	2458	1.714	1.703	-0.011	-0.642
08/30/89	242	2498	0.636	0.598	-0.038	-5.975
08/31/89	243	2527	0.472	0.606	0.134	28.390
09/01/89	244	2530	0.688	0.677	-0.011	-1.599
09/05/89	248	2601	0.142	0.167	0.025	17.606

TABLE G-1. NMOC INHOUSE QUALITY CONTROL SAMPLES (CHANNEL A)

Date Analyzed	Julian Date Analyzed	QC I.D. Number	Calculated NMOC ppmC	Measured NMOC ppmC	NMOC Bias ppmC	NMOC Percent Bias
09/07/89	250	2629	0.916	0.931	0.015	1.638
09/08/89	251	2645	0.707	0.689	-0.018	-2.546
09/13/89	256	2735	0.656	0.708	0.052	7.927
09/14/89	257	2757	1.049	1.080	0.031	2.955
09/15/89	258	2779	1.089	1.170	0.081	7.438
09/20/89	263	2854	0.246	0.248	0.002	0.813
09/22/89	265	2906	0.357	0.347	-0.010	-2.801

TABLE G-2. NMOC INHOUSE QUALITY CONTROL SAMPLES (CHANNEL B)

Date Analyzed	Julian Date Analyzed	QC I.D. Number	Calculated NMOC ppmC	Measured NMOC ppmC	NMOC Bias ppmC	NMOC Percent Bias
06/06/89	157	1002	0.461	0.458	-0.003	-0.651
06/07/89	158	1003	0.529	0.546	0.017	3.289
06/08/89	159	1004	0.759	0.754	-0.005	-0.659
06/09/89	160	1058	0.404	0.364	-0.040	-9.901
06/12/89	163	1086	0.454	0.466	0.012	2.643
06/14/89	165	1111	0.564	0.649	0.085	15.071
06/21/89	172	1233	1.821	1.784	-0.037	-2.032
06/23/89	174	1298	0.508	0.486	-0.022	-4.331
06/26/89	177	1297	0.163	0.147	-0.016	-9.816
06/28/89	179	1354	0.284	0.287	0.003	1.056
06/29/89	180	1373	0.393	0.433	0.040	10.178
06/30/89	181	1418	0.325	0.289	-0.036	-11.077
07/03/89	184	1447	17.557	17.321	-0.236	-1.344
07/06/89	187	1471	16.975	17.557	0.582	3.429
07/10/89	191	1573	8.767	8.404	-0.363	-4.141
07/12/89	193	1599	8.449	8.767	0.318	3.764
07/14/89	195	1654	5.458	5.682	0.224	4.104
07/17/89	198	1682	1.227	1.298	0.071	5.786
07/18/89	199	1708	0.753	0.772	0.019	2.523
07/19/89	200	1734	0.477	0.490	0.013	2.725
07/20/89	201	1762	0.318	0.333	0.015	4.717
07/21/89	202	1788	0.260	0.252	-0.008	-3.077
07/24/89	205	1813	0.207	0.211	0.004	1.932
07/26/89	207	1866	0.242	0.242	0.000	0.000
07/27/89	208	1600	8.767	8.506	-0.261	-2.977
07/28/89	209	1912	0.193	0.191	-0.002	-1.036
07/31/89	212	1939	0.151	0.158	0.007	4.636
08/02/89	214	1988	0.128	0.126	-0.002	-1.563
08/04/89	216	2039	0.291	0.279	-0.012	-4.124
08/07/89	219	2064	0.492	0.504	0.012	2.439
08/09/89	221	2096	0.267	0.255	-0.012	-4.494
08/10/89	222	2143	0.334	0.342	0.008	2.395
08/11/89	223	2168	0.612	0.614	0.002	0.327
08/14/89	226	2190	0.117	0.110	-0.007	-5.983
08/15/89	227	2222	1.149	1.095	-0.054	-4.700
08/21/89	233	2318	0.686	0.667	-0.019	-2.770
08/23/89	235	2369	0.975	0.984	0.009	0.923
08/25/89	237	2422	3.804	3.847	0.043	1.130
08/28/89	240	2458	1.681	1.703	0.022	1.309
08/30/89	242	2498	0.627	0.598	-0.029	-4.625
08/31/89	243	2527	0.461	0.606	0.145	31.453
09/01/89	244	2530	0.686	0.677	-0.009	-1.312
09/05/89	248	2601	0.139	0.167	0.028	20.144

TABLE G-2. NMOC INHOUSE QUALITY CONTROL SAMPLES (CHANNEL B)

Date Analyzed	Julian Date Analyzed	QC I.D. Number	Calculated NMOC ppmC	Measured NMOC ppmC	NMOC Bias ppmC	NMOC Percent Bias
09/07/89	250	2629	0.919	0.931	0.012	1.306
09/08/89	251	2645	0.691	0.689	-0.002	-0.289
09/13/89	256	2735	0.656	0.689	0.033	5.030
09/14/89	257	2757	1.049	1.077	0.028	2.669
09/15/89	258	2779	1.089	1.180	0.091	8.356
09/20/89	263	2854	0.209	0.248	0.039	18.660
09/22/89	265	2906	0.358	0.347	-0.011	-3.073

TABLE G-3. NMOC INHOUSE QUALITY CONTROL SAMPLES (CHANNEL C)

Date Analyzed	Julian Date Analyzed	QC I.D. Number	Calculated NMOC ppmC	Measured NMOC ppmC	NMOC Bias ppmC	NMOC Percent Bias
06/06/89	157	1002	0.456	0.458	0.002	0.439
06/07/89	158	1003	0.542	0.546	0.004	0.812
06/08/89	159	1004	0.741	0.754	0.013	1.754
06/09/89	160	1058	0.403	0.364	-0.039	-9.677
06/12/89	163	1086	0.456	0.466	0.010	2.193
06/14/89	165	1111	0.600	0.649	0.049	8.167
06/21/89	172	1233	1.833	1.784	-0.049	-2.673
06/23/89	174	1298	0.513	0.486	-0.027	-5.263
06/26/89	177	1297	0.160	0.147	-0.013	-8.125
06/28/89	179	1354	0.284	0.292	0.008	2.817
06/29/89	180	1373	0.386	0.433	0.047	12.176
06/30/89	181	1418	0.325	0.296	-0.029	-8.923
07/03/89	184	1447	17.557	17.122	-0.435	-2.478
07/06/89	187	1471	16.993	17.557	0.564	3.319
07/10/89	191	1573	8.767	8.187	-0.580	-6.616
07/12/89	193	1599	8.177	8.767	0.590	7.215
07/14/89	195	1654	5.430	5.682	0.252	4.641
07/17/89	198	1682	1.221	1.298	0.077	6.306
07/18/89	199	1708	0.743	0.772	0.029	3.903
07/19/89	200	1734	0.480	0.490	0.010	2.083
07/20/89	201	1762	0.320	0.333	0.013	4.063
07/21/89	202	1788	0.261	0.252	-0.009	-3.448
07/24/89	205	1813	0.207	0.211	0.004	1.932
07/26/89	207	1866	0.242	0.243	0.001	0.413
07/27/89	208	1600	8.767	8.143	-0.624	-7.118
07/28/89	209	1912	0.193	0.193	0.000	0.000
07/31/89	212	1939	0.151	0.187	0.036	23.841
08/02/89	214	1988	0.127	0.126	-0.001	-0.787
08/04/89	216	2039	0.291	0.275	-0.016	-5.498
08/07/89	219	2064	0.494	0.504	0.010	2.024
08/09/89	221	2096	0.269	0.255	-0.014	-5.204
08/10/89	222	2143	0.342	0.342	0.000	0.000
08/11/89	223	2168	0.612	0.609	-0.003	-0.490
08/14/89	226	2190	0.117	0.109	-0.008	-6.838
08/15/89	227	2222	1.150	1.095	-0.055	-4.783
08/21/89	233	2318	0.679	0.667	-0.012	-1.767
08/23/89	235	2369	0.983	0.984	0.001	0.102
08/25/89	237	2422	3.701	3.847	0.146	3.945
08/28/89	240	2458	1.690	1.703	0.013	0.769
08/30/89	242	2498	0.623	0.598	-0.025	-4.013
08/31/89	243	2527	0.470	0.606	0.136	28.936
09/01/89	244	2530	0.708	0.677	-0.031	-4.379
09/05/89	248	2601	0.148	0.167	0.019	12.838

TABLE G-3. NMOC INHOUSE QUALITY CONTROL SAMPLES (CHANNEL C)

Date Analyzed	Julian Date Analyzed	QC I.D. Number	Calculated NMOC ppmC	Measured NMOC ppmC	NMOC Bias ppmC	NMOC Percent Bias
09/07/89	250	2629	0.941	0.931	-0.010	-1.063
09/08/89	251	2645	0.697	0.689	-0.008	-1.148
09/13/89	256	2735	0.656	0.706	0.050	7.622
09/14/89	257	2757	1.049	1.084	0.035	3.337
09/15/89	258	2779	1.089	1.178	0.089	8.173
09/20/89	263	2854	0.238	0.248	0.010	4.202
09/22/89	265	2906	0.353	0.347	-0.006	-1.700

TABLE G-4. NMOC INHOUSE QUALITY CONTROL SAMPLES (CHANNEL D)

Date Analyzed	Julian Date Analyzed	QC I.D. Number	Calculated NMOC ppmC	Measured NMOC ppmC	NMOC Bias ppmC	NMOC Percent Bias
06/06/89	157	1002	0.453	0.458	0.005	1.104
06/07/89	158	1003	0.525	0.546	0.021	4.076
06/08/89	159	1004	0.743	0.754	0.011	1.480
06/09/89	160	1058	0.393	0.364	-0.029	-7.379
06/12/89	163	1086	0.454	0.466	0.012	2.643
06/14/89	165	1111	0.592	0.649	0.057	9.628
06/21/89	172	1233	1.821	1.784	-0.037	-2.032
06/23/89	174	1298	0.597	0.486	-0.111	-18.593
06/26/89	177	1297	0.155	0.147	-0.008	-5.161
06/28/89	179	1354	0.284	0.284	0.000	0.000
06/29/89	180	1373	0.383	0.433	0.050	13.055
06/30/89	181	1418	0.325	0.306	-0.019	-5.846
07/03/89	184	1447	17.557	16.991	-0.566	-3.224
07/06/89	187	1471	16.712	17.557	0.845	5.056
07/10/89	191	1573	8.767	8.378	-0.389	-4.437
07/12/89	193	1599	8.384	8.767	0.383	4.568
07/14/89	195	1654	5.490	5.682	0.192	3.497
07/17/89	198	1682	1.214	1.298	0.084	6.919
07/18/89	199	1708	0.742	0.772	0.030	4.043
07/19/89	200	1734	0.464	0.490	0.026	5.603
07/20/89	201	1762	0.312	0.333	0.021	6.731
07/21/89	202	1788	0.252	0.252	0.000	0.000
07/24/89	205	1813	0.207	0.206	-0.001	-0.483
07/26/89	207	1866	0.242	0.238	-0.004	-1.653
07/27/89	208	1600	8.767	8.431	-0.336	-3.833
07/28/89	209	1912	0.193	0.190	-0.003	-1.554
07/31/89	212	1939	0.151	0.190	0.039	25.828
08/02/89	214	1988	0.124	0.126	0.002	1.613
08/04/89	216	2039	0.291	0.267	-0.024	-8.247
08/07/89	219	2064	0.484	0.504	0.020	4.132
08/09/89	221	2096	0.262	0.255	-0.007	-2.672
08/10/89	222	2143	0.336	0.342	0.006	1.786
08/11/89	223	2168	0.612	0.603	-0.009	-1.471
08/14/89	226	2190	0.117	0.108	-0.009	-7.692
08/15/89	227	2222	1.138	1.095	-0.043	-3.779
08/16/89	233	2318	0.674	0.667	-0.007	-1.039
08/23/89	235	2369	1.047	0.984	-0.063	-6.017
08/25/89	237	2422	3.811	3.847	0.036	0.945
08/28/89	240	2458	1.710	1.703	-0.007	-0.409
08/30/89	242	2498	0.651	0.598	-0.053	-8.141
08/31/89	243	2527	0.508	0.606	0.098	19.291
09/01/89	244	2530	0.676	0.677	0.001	0.148
09/05/89	248	2601	0.138	0.167	0.029	21.014

TABLE G-4. NMOC INHOUSE QUALITY CONTROL SAMPLES (CHANNEL D)

Date Analyzed	Julian Date Analyzed	QC I.D. Number	Calculated NMOC ppmC	Measured NMOC ppmC	NMOC Bias ppmC	NMOC Percent Bias
09/07/89	250	2629	0.967	0.931	-0.036	-3.723
09/08/89	251	2645	0.747	0.689	-0.058	-7.764
09/13/89	256	2735	0.656	0.704	0.048	7.317
09/14/89	257	2757	1.049	1.073	0.024	2.288
09/15/89	258	2779	1.089	1.170	0.081	7.438
09/20/89	263	2854	0.233	0.248	0.015	6.438
09/22/89	265	2906	0.351	0.347	-0.004	-1.140

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TABLE H-1. MULTIPLE DETECTOR SPECIATED THREE-HOUR DATA SUMMARY FOR C3IL

Sample Date	07/17/89	08/09/89	08/11/89	08/14/89	08/15/89
Sample ID	1748	2174	2223	2283	2277
Total NMOC, ppmC	0.417	0.232	0.211	0.242	0.252
Compound	Concentration, ppbv				
Acetylene	<1.00	3.27 L	<1.00	<1.00	1.73 L
Propylene	<0.10	<0.10	<0.10	<0.10	<0.10
Chloromethane	<0.20	<0.20	<0.20	<0.20	<0.20
Vinyl chloride	<0.20	<0.20	<0.20	<0.20	<0.20
1,3-Butadiene	0.05 H	<0.10	<0.10	<0.10	<0.10
Bromomethane	<0.20	<0.20	<0.20	<0.20	<0.20
Chloroethane	0.05 H	<0.10	<0.10	<0.10	<0.10
Methylene chloride	<0.11	<0.11	1.32 H	<0.11	<0.11
trans-1,2-Dichloroethylene	<0.04	<0.04	<0.04	<0.04	<0.04
1,1-Dichloroethane	<0.04	<0.04	<0.04	<0.04	<0.04
Chloroprene	0.10 H	<0.06	0.06 M	0.13 M	0.08 H
Bromochloromethane	<0.01	<0.01	<0.01	<0.01	<0.01
Chloroform	<0.01	<0.01	<0.01	<0.01	<0.01
1,1,1-Trichloroethane	<0.01	1.09 M	3.13 H	0.83 L	1.13 M
Carbon tetrachloride	0.15 L	0.14 L	0.14 L	0.14 L	0.15 L
1,2-Dichloroethane	<0.04	<0.04	<0.04	<0.04	<0.04
Benzene	2.25 H	1.34 H	0.90 H	0.89 H	0.89 H
Trichloroethylene	<0.01	0.37 H	0.58 M	0.14 L	0.74 H
1,2-Dichloropropane	<0.04	<0.04	<0.04	<0.04	<0.04
Bromodichloromethane	<0.01	<0.01	0.08 M	<0.01	<0.01
cis-1,3-Dichloropropylene	<0.04	<0.04	3.65 H	<0.04	<0.04
Toluene	2.38 M	2.30 H	<0.02	1.45 H	3.41 M
n-Octane/t-1,3-Dichloropropylene	<0.04	<0.04	<0.04	0.31 L	<0.04
1,1,2-Trichloroethane	<0.02	<0.02	<0.02	<0.02	<0.02
Tetrachloroethylene	<0.07	<0.07	<0.07	0.88 L	1.33 L
Dibromochloromethane	<0.01	<0.01	<0.01	<0.01	<0.01
Chlorobenzene	<0.02	<0.02	<0.02	<0.02	<0.02
Ethylbenzene	0.36 H	0.24 H	0.20 H	0.19 H	0.29 H
m/p-Xylene	1.82 H	1.34 H	0.97 H	0.85 H	1.37 H
Styrene/o-Xylene	0.53 H	0.41 H	0.36 H	0.31 H	0.46 H
Bromoform	<0.01	<0.01	<0.01	<0.01	<0.01
1,1,2,2-Tetrachloroethane	<0.01	<0.01	<0.01	<0.01	<0.01
m-Dichlorobenzene	0.03 L	<0.02	<0.02	<0.02	<0.02
p-Dichlorobenzene	<0.09	<0.09	<0.09	<0.09	0.84 L
o-Dichlorobenzene	<0.02	<0.02	<0.02	<0.02	0.07 L

H High confidence level M Medium confidence level L Low confidence level (Continued)

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TABLE H-1. C3IL (Continued)

Sample Date Sample ID	08/16/89 2316	08/17/89 2338D	08/17/89 2338R	08/17/89 2339D	08/18/89 2416
Total NMOC, ppmC	0.304	0.141	0.141	0.150	0.080
Compound	Concentration, ppbv				
Acetylene	<1.00	<1.00	<1.00	<1.00	<1.00
Propylene	<0.10	<0.10	<0.10	<0.10	<0.10
Chloromethane	<0.20	<0.20	<0.20	<0.20	<0.20
Vinyl chloride	<0.20	<0.20	<0.20	<0.20	<0.20
1,3-Butadiene	<0.10	<0.10	<0.10	<0.10	<0.10
Bromomethane	0.07 H	<0.20	<0.20	<0.20	<0.20
Chloroethane	<0.10	<0.10	<0.10	<0.10	<0.10
Methylene chloride	<0.11	2.04 H	2.25 H	1.94 H	<0.11
trans-1,2-Dichloroethylene	<0.04	<0.04	<0.04	<0.04	<0.04
1,1-Dichloroethane	<0.04	<0.04	<0.04	<0.04	<0.04
Chloroprene	0.13 L	<0.06	<0.06	<0.06	<0.06
Bromochloromethane	<0.01	<0.01	<0.01	<0.01	<0.01
Chloroform	<0.01	<0.01	<0.01	<0.01	<0.01
1,1,1-Trichloroethane	2.52 H	1.12 H	1.15 H	1.10 H	0.83 M
Carbon tetrachloride	0.13 L	0.12 L	0.13 L	0.13 L	0.14 L
1,2-Dichloroethane	<0.04	<0.04	<0.04	<0.04	<0.04
Benzene	1.14 H	0.53 H	0.57 H	0.56 H	0.25 H
Trichloroethylene	0.51 H	0.21 H	0.37 M	0.26 H	0.16 L
1,2-Dichloropropane	<0.04	<0.04	<0.04	<0.04	<0.04
Bromodichloromethane	<0.01	<0.01	<0.01	<0.01	<0.01
cis-1,3-Dichloropropylene	<0.04	<0.04	<0.04	<0.04	<0.04
Toluene	3.76 M	1.18 H	1.28 H	1.16 H	0.24 H
n-Octane/t-1,3-Dichloropropylene	0.22 L	<0.04	<0.04	<0.04	<0.04
1,1,2-Trichloroethane	<0.02	<0.02	<0.02	<0.02	<0.02
Tetrachloroethylene	1.82 L	<0.07	<0.07	<0.07	0.09 L
Dibromochloromethane	<0.01	<0.01	<0.01	<0.01	<0.01
Chlorobenzene	<0.02	<0.02	<0.02	<0.02	<0.02
Ethylbenzene	0.37 H	0.12 H	0.12 H	0.12 H	0.04 M
m/p-Xylene	1.84 H	0.59 H	0.64 H	0.59 H	0.18 H
Styrene/o-Xylene	0.56 H	0.16 H	0.22 H	0.21 L	0.06 H
Bromoform	<0.01	<0.01	<0.01	<0.01	<0.01
1,1,2,2-Tetrachloroethane	<0.01	<0.01	<0.01	<0.01	<0.01
m-Dichlorobenzene	0.02 L	<0.02	<0.02	<0.02	<0.02
p-Dichlorobenzene	<0.09	<0.09	<0.09	<0.09	<0.09
o-Dichlorobenzene	<0.02	<0.02	<0.02	<0.02	<0.02

H High confidence level M Medium confidence level L Low confidence level (Continued)

D Duplicate sample R Replicate analysis

TABLE H-1. C3IL (Continued)

Sample Date	08/21/89	08/22/89
Sample ID	2378	2400
Total NMOC, ppmC	0.542	0.233
Compound	Concentration, ppbv	
Acetylene	<1.00	<1.00
Propylene	<0.10	<0.10
Chloromethane	<0.20	<0.20
Vinyl chloride	<0.20	<0.20
1,3-Butadiene	<0.10	<0.10
Bromomethane	<0.20	<0.20
Chloroethane	<0.10	<0.10
Methylene chloride	1.61 L	<0.11
trans-1,2-Dichloroethylene	<0.04	<0.04
1,1-Dichloroethane	<0.04	<0.04
Chloroprene	<0.06	<0.06
Bromochloromethane	<0.01	<0.01
Chloroform	<0.01	<0.01
1,1,1-Trichloroethane	1.29 L	0.75 L
Carbon tetrachloride	0.13 L	0.15 L
1,2-Dichloroethane	<0.04	<0.04
Benzene	2.44 H	1.24 M
Trichloroethylene	0.65 L	<0.01
1,2-Dichloropropane	<0.04	0.46 M
Bromodichloromethane	<0.01	<0.01
cis-1,3-Dichloropropylene	<0.04	<0.04
Toluene	6.59 H	3.07 H
n-Octane/t-1,3-Dichloropropylene	<0.04	<0.04
1,1,2-Trichloroethane	<0.02	<0.02
Tetrachloroethylene	1.15 L	<0.07
Dibromochloromethane	<0.01	<0.01
Chlorobenzene	<0.02	<0.02
Ethylbenzene	0.67 H	0.22 H
m/p-Xylene	3.59 H	1.16 H
Styrene/o-Xylene	1.09 H	0.36 L
Bromoform	<0.01	<0.01
1,1,2,2-Tetrachloroethane	<0.01	<0.01
m-Dichlorobenzene	<0.02	<0.02
p-Dichlorobenzene	0.20 H	0.08 M
o-Dichlorobenzene	<0.02	<0.02

H High confidence level M Medium confidence level L Low confidence level

TABLE H-2. MULTIPLE DETECTOR SPECIATED THREE-HOUR DATA SUMMARY FOR C6IL

Sample Date Sample ID	07/17/89 1749	08/09/89 2173	08/11/89 2224	08/15/89 2276	08/16/89 2317
Total NMOC, ppmC	0.973	0.960	1.442	0.628	0.963
Compound	Concentration, ppbv				
Acetylene	<1.00	<1.00	17.33 L	<1.00	<1.00
Propylene	<0.10	<0.10	<0.10	<0.10	<0.10
Chloromethane	<0.20	<0.20	<0.20	<0.20	<0.20
Vinyl chloride	<0.20	<0.20	<0.20	<0.20	<0.20
1,3-Butadiene	1.04 M	0.77 M	1.07 H	0.56 H	<0.10
Bromomethane	<0.20	<0.20	<0.20	<0.20	<0.20
Chloroethane	<0.10	<0.10	<0.10	<0.10	<0.10
Methylene chloride	<0.11	<0.11	<0.11	<0.11	<0.11
trans-1,2-Dichloroethylene	<0.04	<0.04	<0.04	<0.04	<0.04
1,1-Dichloroethane	<0.04	<0.04	<0.04	<0.04	<0.04
Chloroprene	0.03 M	0.03 M	<0.06	<0.06	0.24 M
Bromochloromethane	<0.01	<0.01	<0.01	<0.01	<0.01
Chloroform	<0.01	<0.01	<0.01	<0.01	<0.01
1,1,1-Trichloroethane	1.35 M	1.39 M	2.54 M	1.52 H	2.85 H
Carbon tetrachloride	0.14 L	0.16 L	0.17 L	0.20 L	0.13 L
1,2-Dichloroethane	<0.04	<0.04	<0.04	<0.04	<0.04
Benzene	8.16 H	5.35 M	8.30 H	3.61 H	4.04 H
Trichloroethylene	0.39 L	0.44 M	1.76 H	0.94 M	1.15 M
1,2-Dichloropropane	<0.04	1.04 M	<0.04	<0.04	<0.04
Bromodichloromethane	<0.01	<0.01	<0.01	<0.01	<0.01
cis-1,3-Dichloropropylene	<0.04	<0.04	<0.04	<0.04	<0.04
Toluene	10.53 H	9.25 H	27.86 H	9.64 H	10.00 H
n-Octane/t-1,3-Dichloropropylene	<0.04	<0.04	<0.04	<0.04	<0.04
1,1,2-Trichloroethane	<0.02	<0.02	<0.02	<0.02	0.03 M
Tetrachloroethylene	<0.07	<0.07	1.77 L	<0.07	<0.07
Dibromochloromethane	<0.01	<0.01	<0.01	<0.01	<0.01
Chlorobenzene	<0.02	<0.02	<0.02	<0.02	<0.02
Ethylbenzene	1.20 H	1.09 H	1.82 H	1.73 H	3.00 H
m/p-Xylene	6.95 H	6.28 H	10.00 H	9.50 H	17.41 H
Styrene/o-Xylene	2.23 H	2.09 H	3.43 H	2.76 H	4.89 H
Bromoform	<0.01	<0.01	<0.01	<0.01	<0.01
1,1,2,2-Tetrachloroethane	<0.01	<0.01	<0.01	<0.01	<0.01
m-Dichlorobenzene	<0.02	<0.02	<0.02	<0.02	<0.02
p-Dichlorobenzene	1.15 M	0.82 L	<0.09	1.21 M	<0.09
o-Dichlorobenzene	<0.02	<0.02	<0.02	0.40 L	<0.02

H High confidence level   M Medium confidence level   L Low confidence level   (Continued)

TABLE H-2. C6IL (Continued)

Sample Date	08/17/89	08/21/89	08/21/89	08/21/89	08/22/89
Sample ID	2331	2388D	2388R	2389D	2401
Total NMOC, ppmC	1.952	1.811	1.811	1.781	2.663
Compound	Concentration, ppbv				
Acetylene	<1.00	<1.00	<1.00	<1.00	1.75 L
Propylene	19.46 M	<0.10	<0.10	<0.10	<0.10
Chloromethane	<0.20	<0.20	<0.20	<0.20	<0.20
Vinyl chloride	<0.20	<0.20	<0.20	<0.20	<0.20
1,3-Butadiene	1.02 M	1.64 H	1.43 H	1.67 H	0.31 H
Bromomethane	<0.20	<0.20	<0.20	<0.20	<0.20
Chloroethane	<0.10	<0.10	<0.10	<0.10	<0.10
Methylene chloride	2.78 L	<0.11	<0.11	<0.11	<0.11
trans-1,2-Dichloroethylene	<0.04	<0.04	<0.04	<0.04	<0.04
1,1-Dichloroethane	<0.04	<0.04	<0.04	<0.04	<0.04
Chloroprene	0.12 L	0.18 L	<0.06	<0.06	1.30 H
Bromochloromethane	<0.01	<0.01	<0.01	<0.01	<0.01
Chloroform	<0.01	<0.01	<0.01	<0.01	<0.01
1,1,1-Trichloroethane	6.27 H	2.33 M	2.13 M	2.34 H	6.87 H
Carbon tetrachloride	0.15 L	0.17 L	0.17 L	0.17 L	0.21 L
1,2-Dichloroethane	<0.04	<0.04	<0.04	<0.04	<0.04
Benzene	6.39 H	8.93 H	8.68 H	8.72 H	2.20 H
Trichloroethylene	0.97 L	1.19 H	1.41 M	1.67 L	0.92 M
1,2-Dichloropropane	1.35 H	<0.04	<0.04	<0.04	1.64 H
Bromodichloromethane	<0.01	<0.01	<0.01	<0.01	<0.01
cis-1,3-Dichloropropylene	<0.04	<0.04	<0.04	<0.04	<0.04
Toluene	23.74 H	21.04 H	21.07 H	21.72 H	54.31 H
n-Octane/t-1,3-Dichloropropylene	1.53 L	<0.04	<0.04	<0.04	<0.04
1,1,2-Trichloroethane	0.08 M	0.05 M	0.06 M	<0.02	<0.02
Tetrachloroethylene	2.98 L	<0.07	<0.07	<0.07	1.76 L
Dibromochloromethane	<0.01	<0.01	<0.01	<0.01	<0.01
Chlorobenzene	<0.02	<0.02	<0.02	0.03 L	0.95 H
Ethylbenzene	16.48 H	3.77 H	3.66 H	3.65 H	2.08 H
m/p-Xylene	88.90 H	20.98 H	20.16 H	20.02 H	7.60 H
Styrene/o-Xylene	18.64	6.89 H	6.70 H	6.48 H	4.62 H
Bromoform	<0.01	<0.01	<0.01	<0.01	<0.01
1,1,2,2-Tetrachloroethane	<0.01	<0.01	<0.01	<0.01	<0.01
m-Dichlorobenzene	<0.02	<0.02	0.02 L	<0.02	<0.02
p-Dichlorobenzene	<0.09	<0.09	<0.09	<0.09	<0.09
o-Dichlorobenzene	<0.02	<0.02	<0.02	0.12 L	<0.02

H High confidence level   M Medium confidence level   L Low confidence level   (Continued)
D Duplicate sample   R Replicate analysis

TABLE H-2. C6IL (Continued)

Sample Date	08/31/89
Sample ID	2581
Total NMOC, ppmC	0.732
Compound	Concentration, ppbv
Acetylene	<1.00
Propylene	<0.10
Chloromethane	<0.20
Vinyl chloride	<0.20
1,3-Butadiene	<0.10
Bromomethane	<0.20
Chloroethane	<0.10
Methylene chloride	<0.11
trans-1,2-Dichloroethylene	<0.04
1,1-Dichloroethane	<0.04
Chloroprene	0.56 M
Bromochloromethane	<0.01
Chloroform	<0.01
1,1,1-Trichloroethane	0.98 H
Carbon tetrachloride	0.11 L
1,2-Dichloroethane	<0.04
Benzene	3.83 H
Trichloroethylene	0.37 H
1,2-Dichloropropane	<0.04
Bromodichloromethane	<0.01
cis-1,3-Dichloropropylene	<0.04
Toluene	9.05 H
n-Octane/t-1,3-Dichloropropylene	<0.04
1,1,2-Trichloroethane	<0.02
Tetrachloroethylene	<0.07
Dibromochloromethane	<0.01
Chlorobenzene	<0.02
Ethylbenzene	1.05 H
m/p-Xylene	5.64 H
Styrene/o-Xylene	1.80 L
Bromoform	<0.01
1,1,2,2-Tetrachloroethane	<0.01
m-Dichlorobenzene	<0.02
p-Dichlorobenzene	<0.09
o-Dichlorobenzene	<0.02

H High confidence level M Medium confidence level L Low confidence level

TABLE H-3. MULTIPLE DETECTOR SPECIATED THREE-HOUR DATA SUMMARY FOR GRMI

Sample Date	07/17/89	08/03/89	08/03/89	08/03/89	08/09/89
Sample ID	1761	2093D	2093R	2094D	2180
Total NMOC, ppmC	1.001	0.586	0.586	0.567	1.394
Compound	Concentration, ppbv				
Acetylene	<1.00	<1.00	<1.00	<1.00	<1.00
Propylene	<0.10	<0.10	<0.10	<0.10	<0.10
Chloromethane	<0.20	<0.20	<0.20	<0.20	<0.20
Vinyl chloride	<0.20	<0.20	<0.20	<0.20	<0.20
1,3-Butadiene	0.70 M	0.42 M	0.45 M	0.42 L	0.81 M
Bromomethane	<0.20	<0.20	<0.20	<0.20	<0.20
Chloroethane	<0.10	<0.10	<0.10	<0.10	<0.10
Methylene chloride	<0.11	<0.11	<0.11	<0.11	<0.11
trans-1,2-Dichloroethylene	<0.04	<0.04	<0.04	<0.04	<0.04
1,1-Dichloroethane	<0.04	<0.04	<0.04	<0.04	<0.04
Chloroprene	0.13 H	0.19 L	0.10 H	0.08 H	<0.06
Bromochloromethane	<0.01	<0.01	<0.01	<0.01	<0.01
Chloroform	<0.01	<0.01	<0.01	<0.01	<0.01
1,1,1-Trichloroethane	3.43 M	1.55 L	1.60 L	1.54 L	3.50 H
Carbon tetrachloride	0.14 L	0.18 L	0.19 L	0.17 L	0.17 L
1,2-Dichloroethane	<0.04	<0.04	<0.04	<0.04	<0.04
Benzene	3.58 H	2.29 H	2.15 H	2.10 H	4.73 H
Trichloroethylene	7.56 H	0.84 H	0.86 H	0.71 H	3.14 H
1,2-Dichloropropane	<0.04	<0.04	<0.04	<0.04	1.14 H
Bromodichloromethane	<0.01	<0.01	<0.01	<0.01	<0.01
cis-1,3-Dichloropropylene	<0.04	<0.04	<0.04	<0.04	<0.04
Toluene	15.43 H	4.06 H	4.21 H	4.13 L	17.79 H
n-Octane/t-1,3-dichloropropylene	1.87 L	<0.04	<0.04	<0.04	<0.04
1,1,2-Trichloroethane	<0.02	<0.02	<0.02	<0.02	<0.02
Tetrachloroethylene	0.35 H	<0.07	0.53 L	0.22 L	<0.07
Dibromochloromethane	<0.01	<0.01	<0.01	<0.01	<0.01
Chlorobenzene	<0.02	0.04 M	<0.02	0.05 L	<0.02
Ethylbenzene	1.43 H	0.51 M	0.53 H	0.48 H	1.63 H
m/p-Xylene	8.78 H	2.28 H	2.30 H	2.27 H	9.46 H
Styrene/o-Xylene	2.68 H	0.84 L	0.90 H	0.86 H	2.74 H
Bromoform	<0.01	<0.01	<0.01	<0.01	<0.01
1,1,2,2-Tetrachloroethane	<0.01	<0.01	<0.01	<0.01	<0.01
m-Dichlorobenzene	<0.02	<0.02	<0.02	<0.02	<0.02
p-Dichlorobenzene	<0.09	0.20 M	0.24 M	0.20 M	<0.09
o-Dichlorobenzene	<0.02	<0.02	<0.02	<0.02	<0.02

H High confidence level   M Medium confidence level   L Low confidence level   (Continued)

D Duplicate sample   R Replicate analysis

TABLE H-3. GRMI (Continued)

Sample Date Sample ID	08/11/89 2208	08/14/89 2258	08/15/89 2272	08/16/89 2295	08/17/89 2337
Total NMOC, ppmC	0.414	0.424	0.218	0.636	0.701
Compound	Concentration, ppbv				
Acetylene	<1.00	<1.00	<1.00	<1.00	<1.00
Propylene	<0.10	<0.10	<0.10	<0.10	9.58 M
Chloromethane	<0.20	<0.20	<0.20	<0.20	<0.20
Vinyl chloride	<0.20	<0.20	<0.20	<0.20	<0.20
1,3-Butadiene	0.96 M	0.10 H	0.17 L	<0.10	0.48 H
Bromomethane	<0.20	<0.20	<0.20	<0.20	<0.20
Chloroethane	<0.10	<0.10	<0.10	<0.10	<0.10
Methylene chloride	<0.11	<0.11	<0.11	<0.11	<0.11
trans-1,2-Dichloroethylene	<0.04	<0.04	<0.04	<0.04	<0.04
1,1-Dichloroethane	<0.04	<0.04	<0.04	<0.04	<0.04
Chloroprene	0.10 H	<0.06	<0.06	<0.06	<0.06
Bromochloromethane	<0.01	<0.01	<0.01	<0.01	<0.01
Chloroform	<0.01	<0.01	<0.01	<0.01	<0.01
1,1,1-Trichloroethane	2.89 M	1.17 H	0.85 M	0.76 L	2.21 H
Carbon tetrachloride	0.14 L	0.15 L	0.20 L	0.13 L	0.13 L
1,2-Dichloroethane	<0.04	<0.04	<0.04	<0.04	<0.04
Benzene	5.99 H	1.64 H	1.16 H	2.89 M	2.81 H
Trichloroethylene	2.11 H	0.73 L	0.71 H	0.44 M	0.12 L
1,2-Dichloropropane	<0.04	<0.04	<0.04	<0.04	<0.04
Bromodichloromethane	<0.01	<0.01	<0.01	<0.01	<0.01
cis-1,3-Dichloropropylene	<0.04	<0.04	<0.04	<0.04	<0.04
Toluene	2.07 H	4.96 H	4.37 H	8.45 H	10.33 H
n-Octane/t-1,3-dichloropropylene	<0.04	<0.04	<0.04	<0.04	<0.04
1,1,2-Trichloroethane	<0.02	<0.02	<0.02	<0.02	<0.02
Tetrachloroethylene	<0.07	<0.07	0.14 L	0.07 M	0.25 L
Dibromochloromethane	<0.01	<0.01	<0.01	<0.01	<0.01
Chlorobenzene	<0.02	<0.02	<0.02	<0.02	<0.02
Ethylbenzene	2.17 H	0.60 H	0.41 H	0.69 H	0.68 H
m/p-Xylene	11.83 H	2.78 H	2.07 H	4.05 M	4.00 H
Styrene/o-Xylene	3.58 H	0.82 H	0.64 H	1.25 M	1.38 H
Bromoform	<0.01	<0.01	<0.01	<0.01	<0.01
1,1,2,2-Tetrachloroethane	<0.01	<0.01	<0.01	<0.01	<0.01
m-Dichlorobenzene	<0.02	<0.02	<0.02	<0.02	<0.02
p-Dichlorobenzene	<0.09	<0.09	0.25 L	<0.09	<0.09
o-Dichlorobenzene	<0.02	<0.02	<0.02	<0.02	<0.02

H High confidence level M Medium confidence level L Low confidence level (Continued)

TABLE H-3. GRMI (Continued)

Sample Date	08/21/89
Sample ID	2387
Total NMOC, ppmC	0.364
Compound	Concentration, ppbv
Acetylene	<1.00
Propylene	<0.10
Chloromethane	<0.20
Vinyl chloride	<0.20
1,3-Butadiene	<0.10
Bromomethane	<0.20
Chloroethane	<0.10
Methylene chloride	<0.11
trans-1,2-Dichloroethylene	<0.04
1,1-Dichloroethane	<0.04
Chloroprene	<0.06
Bromochloromethane	<0.01
Chloroform	<0.01
1,1,1-Trichloroethane	2.88 H
Carbon tetrachloride	0.13 L
1,2-Dichloroethane	<0.04
Benzene	1.23 H
Trichloroethylene	0.72 H
1,2-Dichloropropane	0.07 M
Bromodichloromethane	<0.01
cis-1,3-Dichloropropylene	<0.04
Toluene	3.73 H
n-Octane/t-1,3-dichloropropylene	<0.04
1,1,2-Trichloroethane	<0.02
Tetrachloroethylene	0.08 L
Dibromochloromethane	<0.01
Chlorobenzene	<0.02
Ethylbenzene	0.63 H
m/p-Xylene	3.56 H
Styrene/o-Xylene	1.03 H
Bromoform	<0.01
1,1,2,2-Tetrachloroethane	<0.01
m-Dichlorobenzene	<0.02
p-Dichlorobenzene	0.60 L
o-Dichlorobenzene	<0.02

H High confidence level M Medium confidence level L Low confidence level

TABLE H-4. MULTIPLE DETECTOR SPECIATED THREE-HOUR DATA SUMMARY FOR MNY

Sample Date	07/17/89	07/18/89	08/09/89	08/10/89	08/11/89
Sample ID	1757	1753	2176	2197	2230
Total NMOC, ppmC	0.216	0.515	0.127	0.603	0.281
Compound	Concentration, ppbv				
Acetylene	<1.00	8.69 L	1.23 L	6.94 L	<1.00
Propylene	2.39 M	<0.10	3.37 H	<0.10	<0.10
Chloromethane	<0.20	<0.20	<0.20	<0.20	<0.20
Vinyl chloride	<0.20	<0.20	<0.20	<0.20	<0.20
1,3-Butadiene	0.14 H	0.28 H	0.10 H	0.29 H	0.17 H
Bromomethane	<0.20	<0.20	<0.20	<0.20	<0.20
Chloroethane	0.11 L	<0.10	<0.10	<0.10	<0.10
Methylene chloride	<0.11	<0.11	1.87 L	<0.11	<0.11
trans-1,2-Dichloroethylene	<0.04	<0.04	<0.04	<0.04	<0.04
1,1-Dichloroethane	<0.04	<0.04	<0.04	<0.04	<0.04
Chloroprene	0.50 L	0.09 H	<0.06	<0.06	<0.06
Bromochloromethane	<0.01	<0.01	<0.01	<0.01	<0.01
Chloroform	<0.01	<0.01	<0.01	0.10 H	<0.01
1,1,1-Trichloroethane	0.90 H	1.11 H	1.06 H	1.27 M	0.56 H
Carbon tetrachloride	0.14 L	0.14 L	0.15 L	0.16 L	0.14 L
1,2-Dichloroethane	<0.04	<0.04	<0.04	<0.04	<0.04
Benzene	0.98 H	2.33 H	0.94 H	2.31 H	1.30 H
Trichloroethylene	0.05 H	0.19 M	<0.01	0.22 L	<0.01
1,2-Dichloropropane	<0.04	<0.04	<0.04	<0.04	<0.04
Bromodichloromethane	<0.01	<0.01	<0.01	<0.01	<0.01
cis-1,3-Dichloropropylene	<0.04	<0.04	<0.04	<0.04	<0.04
Toluene	2.01 H	5.15 H	3.02 H	8.04 H	2.81 H
n-Octane/t-1,3-dichloropropylene	<0.04	<0.04	<0.04	<0.04	<0.04
1,1,2-Trichloroethane	<0.02	<0.02	<0.02	<0.02	<0.02
Tetrachloroethylene	4.85 H	3.53 L	<0.07	3.03 L	<0.07
Dibromochloromethane	<0.01	<0.01	<0.01	<0.01	<0.01
Chlorobenzene	<0.02	<0.02	<0.02	<0.02	<0.02
Ethylbenzene	0.19 H	0.59 H	0.23 H	0.56 H	0.28 H
m/p-Xylene	1.16 H	3.33 H	1.32 H	3.82 H	1.61 H
Styrene/o-Xylene	0.44 L	1.19 H	0.52 L	1.33 H	0.63 H
Bromoform	<0.01	<0.01	<0.01	<0.01	<0.01
1,1,2,2-Tetrachloroethane	<0.01	<0.01	<0.01	<0.01	<0.01
m-Dichlorobenzene	<0.02	<0.02	<0.02	<0.02	<0.02
p-Dichlorobenzene	0.13 H	<0.09	0.17 H	0.30 M	0.16 M
o-Dichlorobenzene	<0.02	0.30 L	0.23 M	<0.02	<0.02

H High confidence level M Medium confidence level L Low confidence level (Continued)

TABLE H-4. MNY (Continued)

Sample Date Sample ID	08/15/89 2286	08/16/89 2284D	08/16/89 2284R	08/16/89 2285D	08/18/89 2362
Total NMOC, ppmC	1.006	0.566	0.566	0.556	0.259
Compound	Concentration, ppbv				
Acetylene	<1.00	<1.00	<1.00	<1.00	1.02 L
Propylene	<0.10	<0.10	<0.10	<0.10	3.02 H
Chloromethane	<0.20	<0.20	<0.20	<0.20	<0.20
Vinyl chloride	<0.20	<0.20	<0.20	<0.20	<0.20
1,3-Butadiene	0.62 M	0.32 M	0.30 H	0.32 H	0.13 H
Bromomethane	<0.20	<0.20	<0.20	<0.20	<0.20
Chloroethane	<0.10	<0.10	<0.10	<0.10	<0.10
Methylene chloride	<0.11	<0.11	<0.11	<0.11	<0.11
trans-1,2-Dichloroethylene	<0.04	<0.04	<0.04	<0.04	<0.04
1,1-Dichloroethane	<0.04	<0.04	<0.04	<0.04	<0.04
Chloroprene	<0.06	0.24 M	<0.06	0.09 M	0.08 H
Bromochloromethane	<0.01	<0.01	<0.01	<0.01	<0.01
Chloroform	<0.01	<0.01	<0.01	<0.01	<0.01
1,1,1-Trichloroethane	1.79 H	1.20 H	1.06 H	0.97 H	0.58 M
Carbon tetrachloride	0.17 L	0.18 L	0.16 L	0.15 L	0.15 L
1,2-Dichloroethane	<0.04	<0.04	<0.04	<0.04	<0.04
Benzene	4.18 M	2.27 H	2.37 H	2.32 H	1.12 H
Trichloroethylene	0.21 L	<0.01	0.04 M	<0.01	0.03 L
1,2-Dichloropropane	<0.04	<0.04	<0.04	<0.04	<0.04
Bromodichloromethane	<0.01	<0.01	<0.01	<0.01	<0.01
cis-1,3-Dichloropropylene	<0.04	<0.04	<0.04	<0.04	0.29 L
Toluene	13.38 H	5.37 L	5.41 M	5.49 M	2.54 L
n-Octane/t-1,3-dichloropropylene	<0.04	<0.04	<0.04	<0.04	<0.04
1,1,2-Trichloroethane	<0.02	0.11 M	<0.02	<0.02	<0.02
Tetrachloroethylene	3.93 H	2.00 H	1.98 H	2.58 M	1.07 L
Dibromochloromethane	<0.01	<0.01	<0.01	<0.01	<0.01
Chlorobenzene	<0.02	<0.02	0.27 M	0.13 M	<0.02
Ethylbenzene	1.24 H	0.65 H	0.94 L	0.68 H	0.26 H
m/p-Xylene	6.86 H	4.06 H	3.99 H	3.71 H	1.43 H
Styrene/o-Xylene	2.52 H	1.75 H	1.69 M	1.73 H	0.56 H
Bromoform	<0.01	<0.01	<0.01	<0.01	<0.01
1,1,2,2-Tetrachloroethane	<0.01	<0.01	<0.01	<0.01	<0.01
m-Dichlorobenzene	<0.02	0.03 M	<0.02	<0.02	<0.02
p-Dichlorobenzene	<0.09	<0.09	<0.09	<0.09	<0.09
o-Dichlorobenzene	<0.02	<0.02	<0.02	<0.02	<0.02

H High confidence level
M Medium confidence level
L Low confidence level
D Duplicate sample
R Replicate analysis

(Continued)

TABLE H-4. MNY (Continued)

Sample Date	08/17/89
Sample ID	2358
Total NMOC, ppmC	0.405
Compound	**Concentration, ppbv**
Acetylene	<1.00
Propylene	6.22 H
Chloromethane	<0.20
Vinyl chloride	<0.20
1,3-Butadiene	0.16 H
Bromomethane	<0.20
Chloroethane	<0.10
Methylene chloride	<0.11
trans-1,2-Dichloroethylene	<0.04
1,1-Dichloroethane	<0.04
Chloroprene	0.52 H
Bromochloromethane	<0.01
Chloroform	0.10 H
1,1,1-Trichloroethane	0.93 H
Carbon tetrachloride	0.14 L
1,2-Dichloroethane	<0.04
Benzene	1.45 H
Trichloroethylene	0.09 L
1,2-Dichloropropane	<0.04
Bromodichloromethane	<0.01
cis-1,3-Dichloropropylene	<0.04
Toluene	3.51 M
n-Octane/t-1,3-dichloropropylene	<0.04
1,1,2-Trichloroethane	<0.02
Tetrachloroethylene	2.46 H
Dibromochloromethane	<0.01
Chlorobenzene	<0.02
Ethylbenzene	0.37 H
m/p-Xylene	2.06 H
Styrene/o-Xylene	0.78 H
Bromoform	<0.01
1,1,2,2-Tetrachloroethane	<0.01
m-Dichlorobenzene	0.01 H
p-Dichlorobenzene	<0.09
o-Dichlorobenzene	<0.02

H High confidence level M Medium confidence level L Low confidence level

TABLE H-5. MULTIPLE DETECTOR SPECIATED THREE-HOUR DATA SUMMARY FOR M1NY

Sample Date Sample ID	07/17/89 1758	07/18/89 1752	08/09/89 2175	08/10/89 2196	08/11/89 2236
Total NMOC, ppmC	0.309	0.681	0.356	0.799	0.220
Compound	Concentration, ppbv				
Acetylene	<1.00	<1.00	<1.00	<1.00	<1.00
Propylene	3.41 M	8.31 M	<0.10	<0.10	<0.10
Chloromethane	<0.20	<0.20	<0.20	<0.20	<0.20
Vinyl chloride	<0.20	<0.20	<0.20	<0.20	<0.20
1,3-Butadiene	0.17 H	0.54 M	0.26 H	0.53 H	0.14 H
Bromomethane	<0.20	<0.20	<0.20	<0.20	<0.20
Chloroethane	<0.10	<0.10	<0.10	<0.10	<0.10
Methylene chloride	<0.11	<0.11	<0.11	<0.11	<0.11
trans-1,2-Dichloroethylene	<0.04	<0.04	<0.04	<0.04	<0.04
1,1-Dichloroethane	<0.04	<0.04	<0.04	<0.04	<0.04
Chloroprene	<0.06	<0.06	<0.06	<0.06	<0.06
Bromochloromethane	<0.01	<0.01	<0.01	<0.01	<0.01
Chloroform	<0.01	0.09 H	<0.01	<0.01	<0.01
1,1,1-Trichloroethane	0.71 M	1.08 H	0.88 H	3.23 H	0.62 H
Carbon tetrachloride	0.16 L	0.14 L	0.14 L	0.20 L	0.14 L
1,2-Dichloroethane	<0.04	<0.04	<0.04	<0.04	<0.04
Benzene	1.35 H	2.92 H	1.82 H	3.70 H	1.27 H
Trichloroethylene	<0.01	0.17 L	<0.01	0.37 M	0.10 L
1,2-Dichloropropane	<0.04	<0.04	<0.04	<0.04	<0.04
Bromodichloromethane	<0.01	<0.01	<0.01	<0.01	<0.01
cis-1,3-Dichloropropylene	<0.04	<0.04	<0.04	<0.04	<0.04
Toluene	2.92 M	6.12 H	5.05 H	9.98 H	2.84 H
n-Octane/t-1,3-Dichloropropylene	0.12 H	<0.04	<0.04	<0.04	<0.04
1,1,2-Trichloroethane	<0.02	<0.02	<0.02	<0.02	<0.02
Tetrachloroethylene	0.61 L	<0.07	<0.07	1.90 L	<0.07
Dibromochloromethane	<0.01	<0.01	<0.01	<0.01	<0.01
Chlorobenzene	<0.02	<0.02	<0.02	<0.02	0.13 M
Ethylbenzene	0.35 H	0.64 H	0.40 H	0.93 H	0.28 H
m/p-Xylene	2.05 H	3.94 H	2.33 H	5.58 H	1.54 H
Styrene/o-Xylene	0.74 H	0.14 L	0.85 H	2.17 H	0.58 H
Bromoform	<0.01	<0.01	<0.01	<0.01	<0.01
1,1,2,2-Tetrachloroethane	<0.01	<0.01	<0.01	<0.01	<0.01
m-Dichlorobenzene	<0.02	<0.02	<0.02	0.01 L	<0.02
p-Dichlorobenzene	0.22 H	0.35 M	<0.09	1.41 L	0.16 M
o-Dichlorobenzene	<0.02	<0.02	<0.02	<0.02	<0.02

H High confidence level M Medium confidence level L Low confidence level (Continued)

D Duplicate sample R Replicate analysis

TABLE H-5. M1NY (Continued)

Sample Date	08/15/89	08/16/89	08/17/89	08/17/89	/89
Sample ID	2287	2301	2348D	2348R	2349D
Total NMOC, ppmC	2.043	0.795	0.359	0.359	0.312
Compound			Concentration, ppbv		
Acetylene	<1.00	<1.00	<1.00	<1.00	<1.00
Propylene	<0.10	14.19 M	4.61 M	4.82 L	4.63 L
Chloromethane	<0.20	<0.20	<0.20	<0.20	<0.20
Vinyl chloride	<0.20	<0.20	<0.20	<0.20	<0.20
1,3-Butadiene	<0.10	0.52 H	0.20 H	0.18 H	0.15 H
Bromomethane	<0.20	<0.20	<0.20	<0.20	<0.20
Chloroethane	<0.10	1.49 L	0.05 L	<0.10	<0.10
Methylene chloride	<0.11	2.51 L	<0.11	<0.11	<0.11
trans-1,2-Dichloroethylene	<0.04	<0.04	<0.04	<0.04	<0.04
1,1-Dichloroethane	<0.04	<0.04	<0.04	<0.04	<0.04
Chloroprene	0.18 M	0.09 H	<0.06	0.05 H	0.05 H
Bromochloromethane	<0.01	<0.01	<0.01	<0.01	<0.01
Chloroform	<0.01	<0.01	<0.01	<0.01	<0.01
1,1,1-Trichloroethane	4.87 H	3.05 H	0.88 H	0.89 H	0.91 H
Carbon tetrachloride	0.23 L	0.15 L	0.13 L	0.14 L	0.13 L
1,2-Dichloroethane	<0.04	<0.04	<0.04	<0.04	<0.04
Benzene	7.80 H	4.31 H	1.54 H	1.58 H	1.59 H
Trichloroethylene	0.57 H	0.16 L	0.05 L	0.05 L	0.07 L
1,2-Dichloropropane	<0.04	<0.04	<0.04	<0.04	<0.04
Bromodichloromethane	<0.01	<0.01	<0.01	<0.01	<0.01
cis-1,3-Dichloropropylene	<0.04	<0.04	<0.04	0.25 L	<0.04
Toluene	25.01 L	10.15 M	3.64 M	3.75 H	3.68 M
n-Octane/t-1,3-Dichloropropylene	<0.04	<0.04	<0.04	<0.04	<0.04
1,1,2-Trichloroethane	0.11 H	<0.02	<0.02	<0.02	<0.02
Tetrachloroethylene	<0.07	1.91 L	<0.07	<0.07	<0.07
Dibromochloromethane	<0.01	<0.01	<0.01	<0.01	<0.01
Chlorobenzene	<0.02	<0.02	<0.02	<0.02	<0.02
Ethylbenzene	2.06 M	1.30 H	0.37 H	0.39 H	0.40 H
m/p-Xylene	12.01 M	7.24 H	2.11 H	2.07 H	2.18 H
Styrene/o-Xylene	4.55 M	2.94 H	0.80 H	0.79 H	0.84 H
Bromoform	<0.01	<0.01	<0.01	<0.01	<0.01
1,1,2,2-Tetrachloroethane	<0.01	<0.01	<0.01	<0.01	<0.01
m-Dichlorobenzene	<0.02	<0.02	<0.02	0.02 L	<0.02
p-Dichlorobenzene	<0.09	<0.09	1.14 L	0.97 L	<0.09
o-Dichlorobenzene	<0.02	<0.02	<0.02	<0.02	<0.02

H	High confidence level	M	Medium confidence level	L	Low confidence level	(Continued)
D	Duplicate sample	R	Replicate analysis			

TABLE H-5. M1NY (Continued)

Sample Date	08/18/89
Sample ID	2363
Total NMOC, ppmC	0.318
Compound	**Concentration, ppbv**
Acetylene	<1.00
Propylene	4.21 H
Chloromethane	<0.20
Vinyl chloride	<0.20
1,3-Butadiene	0.17 H
Bromomethane	<0.20
Chloroethane	0.74 L
Methylene chloride	<0.11
trans-1,2-Dichloroethylene	<0.04
1,1-Dichloroethane	<0.04
Chloroprene	<0.06
Bromochloromethane	<0.01
Chloroform	<0.01
1,1,1-Trichloroethane	0.77 H
Carbon tetrachloride	0.17 L
1,2-Dichloroethane	<0.04
Benzene	1.42 H
Trichloroethylene	0.07 M
1,2-Dichloropropane	<0.04
Bromodichloromethane	<0.01
cis-1,3-Dichloropropylene	<0.04
Toluene	3.50 H
n-Octane/t-1,3-Dichloropropylene	<0.04
1,1,2-Trichloroethane	<0.02
Tetrachloroethylene	1.57 H
Dibromochloromethane	<0.01
Chlorobenzene	<0.02
Ethylbenzene	0.42 H
m/p-Xylene	2.33 M
Styrene/o-Xylene	0.84 H
Bromoform	<0.01
1,1,2,2-Tetrachloroethane	<0.01
m-Dichlorobenzene	0.01 L
p-Dichlorobenzene	<0.09
o-Dichlorobenzene	<0.02

H High confidence level M Medium confidence level L Low confidence level

TABLE H-6. MULTIPLE DETECTOR SPECIATED THREE-HOUR DATA SUMMARY FOR NWNJ

Sample Date Sample ID	07/14/89 1760	08/08/89 2199	08/09/89 2169D	08/09/89 2169R	08/09/89 2170D
Total NMOC, ppmC	1.112	0.254	0.319	0.319	0.298
Compound			Concentration, ppbv		
Acetylene	<1.00	<1.00	<1.00	<1.00	<1.00
Propylene	<0.10	<0.10	<0.10	<0.10	<0.10
Chloromethane	<0.20	<0.20	<0.20	<0.20	<0.20
Vinyl chloride	<0.20	<0.20	<0.20	<0.20	<0.20
1,3-Butadiene	0.51 H	0.11 H	0.09 M	0.07 H	0.09 H
Bromomethane	<0.20	<0.20	<0.20	<0.20	<0.20
Chloroethane	<0.10	<0.10	<0.10	<0.10	<0.10
Methylene chloride	5.57 H	<0.11	0.96 H	0.87 L	0.96 L
trans-1,2-Dichloroethylene	<0.04	<0.04	<0.04	<0.04	<0.04
1,1-Dichloroethane	<0.04	<0.04	<0.04	<0.04	<0.04
Chloroprene	<0.06	<0.06	0.07 L	0.06 H	0.07 H
Bromochloromethane	<0.01	<0.01	<0.01	<0.01	<0.01
Chloroform	<0.01	<0.01	<0.01	<0.01	<0.01
1,1,1-Trichloroethane	1.79 H	0.51 L	1.75 H	1.69 H	1.64 H
Carbon tetrachloride	0.14 L	0.13 L	0.15 L	0.14 L	0.14 L
1,2-Dichloroethane	<0.04	<0.04	<0.04	<0.04	<0.04
Benzene	2.85 H	1.15 H	0.94 H	0.89 H	0.92 H
Trichloroethylene	1.95 M	<0.01	0.36 M	0.26 H	0.31 L
1,2-Dichloropropane	<0.04	0.29 H	<0.04	<0.04	<0.04
Bromodichloromethane	<0.01	<0.01	<0.01	<0.01	<0.01
cis-1,3-Dichloropropylene	0.92 L	<0.04	<0.04	<0.04	<0.04
Toluene	23.67 H	2.40 H	3.82 H	3.65 H	4.00 H
n-Octane/t-1,3-Dichloropropylene	<0.04	<0.04	<0.04	<0.04	<0.04
1,1,2-Trichloroethane	0.51 H	<0.02	<0.02	<0.02	<0.02
Tetrachloroethylene	1.78 L	<0.07	<0.07	<0.07	<0.07
Dibromochloromethane	<0.01	<0.01	<0.01	<0.01	<0.01
Chlorobenzene	<0.02	<0.02	<0.02	<0.02	<0.02
Ethylbenzene	1.04 H	0.33 H	1.54 H	1.46 H	1.47 H
m/p-Xylene	6.66 H	2.03 H	7.58 H	7.20 H	7.22 H
Styrene/o-Xylene	2.18 H	0.66 L	1.56 H	1.54 H	1.50 H
Bromoform	<0.01	<0.01	<0.01	<0.01	<0.01
1,1,2,2-Tetrachloroethane	<0.01	<0.01	<0.01	<0.01	<0.01
m-Dichlorobenzene	0.13 L	<0.02	0.01 L	<0.02	0.06 L
p-Dichlorobenzene	2.54 L	0.09 H	<0.09	0.08 M	<0.09
o-Dichlorobenzene	<0.02	<0.02	<0.02	0.90 L	<0.02

H High confidence level M Medium confidence level L Low confidence level (Continued)

D Duplicate sample R Replicate analysis

TABLE H-6. NWNJ (Continued)

Sample Date Sample ID	08/14/89 2265	08/15/89 2297	08/16/89 2364	08/18/89 2419	08/22/89 2448
Total NMOC, ppmC	1.356	1.981	0.551	0.324	0.307
Compound	Concentration, ppbv				
Acetylene	<1.00	<1.00	<1.00	<1.00	<1.00
Propylene	<0.10	<0.10	<0.10	<0.10	<0.10
Chloromethane	<0.20	<0.20	<0.20	<0.20	<0.20
Vinyl chloride	<0.20	<0.20	<0.20	<0.20	<0.20
1,3-Butadiene	0.96 M	<0.10	0.29 H	<0.10	0.10 M
Bromomethane	<0.20	<0.20	<0.20	<0.20	<0.20
Chloroethane	<0.10	<0.10	<0.10	<0.10	<0.10
Methylene chloride	<0.11	<0.11	<0.11	1.29 H	<0.11
trans-1,2-Dichloroethylene	<0.04	<0.04	<0.04	<0.04	<0.04
1,1-Dichloroethane	<0.04	<0.04	<0.04	<0.04	<0.04
Chloroprene	<0.06	<0.06	0.56 M	<0.06	<0.06
Bromochloromethane	<0.01	<0.01	<0.01	<0.01	<0.01
Chloroform	<0.01	<0.01	<0.01	<0.01	<0.01
1,1,1-Trichloroethane	2.02 L	2.57 M	1.18 L	0.60 L	0.49 M
Carbon tetrachloride	0.17 L	0.21 L	0.15 L	0.14 L	0.13 L
1,2-Dichloroethane	<0.04	<0.04	<0.04	<0.04	<0.04
Benzene	5.44 M	5.98 M	2.18 H	1.18 H	1.20 H
Trichloroethylene	0.55 M	1.00 L	1.48 H	0.19 M	<0.01
1,2-Dichloropropane	0.93 L	<0.04	<0.04	<0.04	<0.04
Bromodichloromethane	<0.01	<0.01	<0.01	<0.01	<0.01
cis-1,3-Dichloropropylene	<0.04	<0.04	<0.04	<0.04	<0.04
Toluene	18.21 H	20.17 M	6.72 H	8.54 H	4.43 L
n-Octane/t-1,3-Dichloropropylene	0.61 M	<0.04	<0.04	<0.04	<0.04
1,1,2-Trichloroethane	<0.02	<0.02	<0.02	<0.02	<0.02
Tetrachloroethylene	0.71 L	1.01 M	0.75 L	0.15 L	1.04 L
Dibromochloromethane	<0.01	<0.01	<0.01	<0.01	<0.01
Chlorobenzene	0.26 H	1.29 M	<0.02	<0.02	<0.02
Ethylbenzene	1.76 M	2.44 M	0.96 M	0.42 H	0.36 H
m/p-Xylene	10.16 M	14.07 M	5.01 H	2.52 H	2.02 M
Styrene/o-Xylene	3.50 M	5.06 M	1.78 M	0.77 L	0.85 M
Bromoform	<0.01	<0.01	<0.01	<0.01	<0.01
1,1,2,2-Tetrachloroethane	<0.01	<0.01	<0.01	<0.01	<0.01
m-Dichlorobenzene	<0.02	<0.02	0.02 L	<0.02	<0.02
p-Dichlorobenzene	<0.09	<0.09	<0.09	<0.09	0.12 L
o-Dichlorobenzene	<0.02	<0.02	<0.02	<0.02	<0.02

H High confidence level M Medium confidence level L Low confidence level (Continued)

TABLE H-6. NWNJ (Continued)

Sample Date Sample ID	08/24/89 2433
Total NMOC, ppmC	0.315
Compound	Concentration, ppbv
Acetylene	<1.00
Propylene	<0.10
Chloromethane	<0.20
Vinyl chloride	<0.20
1,3-Butadiene	0.16 H
Bromomethane	<0.20
Chloroethane	<0.10
Methylene chloride	<0.11
trans-1,2-Dichloroethylene	<0.04
1,1-Dichloroethane	<0.04
Chloroprene	<0.06
Bromochloromethane	<0.01
Chloroform	<0.01
1,1,1-Trichloroethane	1.10 M
Carbon tetrachloride	0.13 L
1,2-Dichloroethane	<0.04
Benzene	1.33 H
Trichloroethylene	0.11 L
1,2-Dichloropropane	<0.04
Bromodichloromethane	<0.01
cis-1,3-Dichloropropylene	<0.04
Toluene	4.48 H
n-Octane/t-1,3-Dichloropropylene	<0.04
1,1,2-Trichloroethane	<0.02
Tetrachloroethylene	1.55 M
Dibromochloromethane	<0.01
Chlorobenzene	<0.02
Ethylbenzene	0.44 H
m/p-Xylene	2.44 H
Styrene/o-Xylene	0.83 H
Bromoform	<0.01
1,1,2,2-Tetrachloroethane	<0.01
m-Dichlorobenzene	<0.02
p-Dichlorobenzene	<0.09
o-Dichlorobenzene	<0.02

H High confidence level   M Medium confidenre level   L Low confidence level

TABLE H-7. MULTIPLE DETECTOR SPECIATED THREE-HOUR DATA SUMMARY FOR PLNJ

Sample Date	08/08/89	08/09/89	08/14/89	08/14/89	08/14/89
Sample ID	2198	2193	2314D	2314R	2315D
Total NMOC, ppmC	0.104	0.525	0.764	0.764	0.758
Compound	Concentration, ppbv				
Acetylene	<1.00	<1.00	<1.00	<1.00	<1.00
Propylene	1.52 L	<0.10	<0.10	<0.10	<0.10
Chloromethane	<0.20	<0.20	<0.20	<0.20	<0.20
Vinyl chloride	<0.20	<0.20	<0.20	<0.20	<0.20
1,3-Butadiene	<0.10	0.46 H	0.52 H	0.42 H	0.45 H
Bromomethane	<0.20	<0.20	<0.20	<0.20	<0.20
Chloroethane	<0.10	<0.10	<0.10	<0.10	<0.10
Methylene chloride	<0.11	<0.11	9.45 M	10.29 L	10.08 M
trans-1,2-Dichloroethylene	<0.04	<0.04	<0.04	<0.04	<0.04
1,1-Dichloroethane	<0.04	<0.04	<0.04	<0.04	<0.04
Chloroprene	<0.06	<0.06	0.10 M	<0.06	<0.06
Bromochloromethane	<0.01	<0.01	<0.01	<0.01	<0.01
Chloroform	<0.01	<0.01	<0.01	<0.01	<0.01
1,1,1-Trichloroethane	0.28 L	2.04 H	1.93 H	2.02 H	1.91 H
Carbon tetrachloride	0.14 L	0.13 L	0.15 L	0.16 L	0.15 L
1,2-Dichloroethane	<0.04	<0.04	<0.04	<0.04	<0.04
Benzene	0.49 H	2.64 H	3.38 H	3.36 H	2.94 H
Trichloroethylene	<0.01	<0.01	<0.01	0.60 L	0.34 H
1,2-Dichloropropane	<0.04	0.26 H	<0.04	<0.04	<0.04
Bromodichloromethane	<0.01	<0.01	<0.01	<0.01	<0.01
cis-1,3-Dichloropropylene	<0.04	<0.04	<0.04	<0.04	0.71 L
Toluene	1.04 H	6.03 H	9.02 H	8.05 H	8.00 H
n-Octane/t-1,3-Dichloropropylene	<0.04	<0.04	<0.04	<0.04	<0.04
1,1,2-Trichloroethane	0.01 M	<0.02	<0.02	<0.02	<0.02
Tetrachloroethylene	0.04 L	<0.07	0.78 L	0.73 M	<0.07
Dibromochloromethane	<0.01	<0.01	<0.01	<0.01	<0.01
Chlorobenzene	<0.02	<0.02	<0.02	0.03 M	0.07 H
Ethylbenzene	0.08 M	0.51 H	0.97 H	0.97 H	0.96 H
m/p-Xylene	0.40 H	3.18 H	5.07 H	4.74 H	4.90 H
Styrene/o-Xylene	0.18 H	1.18 H	1.90 H	1.75 H	2.03 H
Bromoform	<0.01	<0.01	<0.01	<0.01	<0.01
1,1,2,2-Tetrachloroethane	<0.01	<0.01	<0.01	<0.01	<0.01
m-Dichlorobenzene	<0.02	<0.02	<0.02	<0.02	<0.02
p-Dichlorobenzene	0.05 L	<0.09	1.96 M	2.30 M	1.33 L
o-Dichlorobenzene	0.20 L	<0.02	<0.02	<0.02	<0.02

H High confidence level M Medium confidence level L Low confidence level (Continued)

D Duplicate sample R Replicate analysis

TABLE H-7. PLNJ (Continued)

Sample Date Sample ID	08/15/89 2303	08/17/89 2342	08/18/89 2409	08/21/89 2413	08/22/89 2453
Total NMOC, ppmC	0.888	0.405	0.294	0.353	0.161
Compound	Concentration, ppbv				
Acetylene	3.89 L	<1.00	<1.00	<1.00	<1.00
Propylene	<0.10	<0.10	<0.10	<0.10	<0.10
Chloromethane	<0.20	<0.20	<0.20	<0.20	<0.20
Vinyl chloride	<0.20	<0.20	<0.20	<0.20	<0.20
1,3-Butadiene	<0.10	0.20 H	<0.10	<0.10	<0.10
Bromomethane	<0.20	<0.20	<0.20	0.06 H	<0.20
Chloroethane	<0.10	<0.10	<0.10	<0.10	<0.10
Methylene chloride	<0.11	<0.11	<0.11	1.87 H	<0.11
trans-1,2-Dichloroethylene	<0.04	<0.04	<0.04	<0.04	<0.04
1,1-Dichloroethane	<0.04	<0.04	<0.04	<0.04	<0.04
Chloroprene	<0.06	0.47 H	<0.06	<0.06	0.31 M
Bromochloromethane	<0.01	<0.01	<0.01	<0.01	<0.01
Chloroform	<0.01	<0.01	<0.01	<0.01	<0.01
1,1,1-Trichloroethane	1.78 L	0.87 H	0.32 L	0.91 L	0.31 M
Carbon tetrachloride	0.17 L	0.14 L	0.13 L	0.15 L	0.15 L
1,2-Dichloroethane	<0.04	<0.04	<0.04	<0.04	<0.04
Benzene	3.48 H	1.71 H	0.97 H	2.06 H	0.92 H
Trichloroethylene	0.27 L	0.16 L	[illegible]	<0.01	0.19 L
1,2-Dichloropropane	<0.04	<0.04	<0.04	<0.04	<0.04
Bromodichloromethane	<0.01	<0.01	<0.01	<0.01	<0.01
cis-1,3-Dichloropropylene	<0.04	0.30 H	<0.04	<0.04	<0.04
Toluene	8.95 L	4.61 H	3.11 H	5.77 H	1.63 H
n-Octane/t-1,3-Dichloropropylene	<0.04	<0.04	<0.04	<0.04	<0.04
1,1,2-Trichloroethane	0.07 L	<0.02	<0.02	<0.02	<0.02
Tetrachloroethylene	1.30 M	<0.07	0.34 L	0.14 M	0.26 H
Dibromochloromethane	<0.01	<0.01	<0.01	<0.01	<0.01
Chlorobenzene	<0.02	<0.02	<0.02	0.06 L	<0.02
Ethylbenzene	0.99 H	0.40 H	0.33 H	0.39 H	0.20 H
m/p-Xylene	5.35 H	2.30 H	1.95 H	2.12 H	1.04 H
Styrene/o-Xylene	1.88 H	0.90 H	1.61 H	0.80 H	0.41 H
Bromoform	<0.01	<0.01	<0.01	<0.01	<0.01
1,1,2,2-Tetrachloroethane	<0.01	<0.01	<0.01	<0.01	<0.01
m-Dichlorobenzene	0.01 L	<0.02	<0.02	<0.02	<0.02
p-Dichlorobenzene	1.22 L	<0.09	0.18 H	<0.09	0.35 L
o-Dichlorobenzene	<0.02	<0.02	<0.02	0.26 L	0.10 L

H High confidence level M Medium confidence level L Low confidence level (Continued)

TABLE H-7. PLNJ (Continued)

Sample Date	08/23/89
Sample ID	2454
Total NMOC, ppmC	0.425
Compound	Concentration, ppbv
Acetylene	<1.00
Propylene	<0.10
Chloromethane	<0.20
Vinyl chloride	<0.20
1,3-Butadiene	0.14 M
Bromomethane	<0.20
Chloroethane	<0.10
Methylene chloride	<0.11
trans-1,2-Dichloroethylene	<0.04
1,1-Dichloroethane	<0.04
Chloroprene	0.10 M
Bromochloromethane	<0.01
Chloroform	<0.01
1,1,1-Trichloroethane	0.73 H
Carbon tetrachloride	0.15 L
1,2-Dichloroethane	<0.04
Benzene	1.68 H
Trichloroethylene	<0.01
1,2-Dichloropropane	<0.04
Bromodichloromethane	<0.01
cis-1,3-Dichloropropylene	<0.04
Toluene	4.13 L
n-Octane/t-1,3-Dichloropropylene	<0.04
1,1,2-Trichloroethane	<0.02
Tetrachloroethylene	<0.07
Dibromochloromethane	<0.01
Chlorobenzene	0.04 H
Ethylbenzene	0.37 H
m/p-Xylene	1.84 H
Styrene/o-Xylene	0.68 M
Bromoform	<0.01
1,1,2,2-Tetrachloroethane	<0.01
m-Dichlorobenzene	<0.02
p-Dichlorobenzene	<0.09
o-Dichlorobenzene	<0.02

H High confidence level M Medium confidence level L Low confidence level